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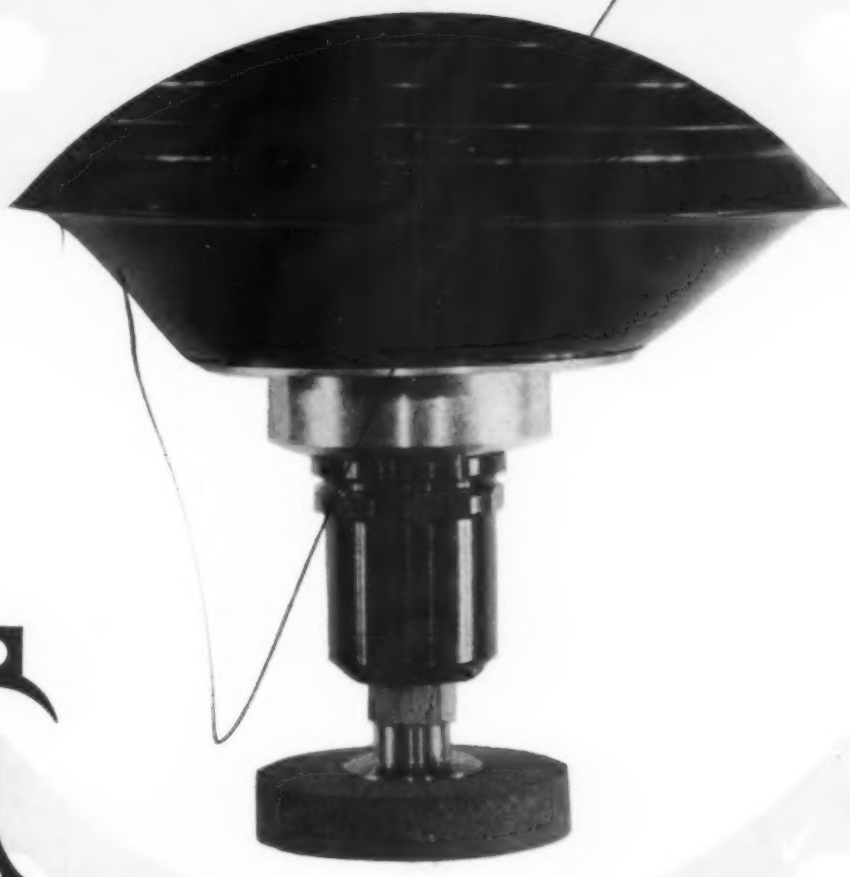
Grinding and Finishing

AUGUST 1961 · 50 CENTS



Jig grinding: versatility in the die shop

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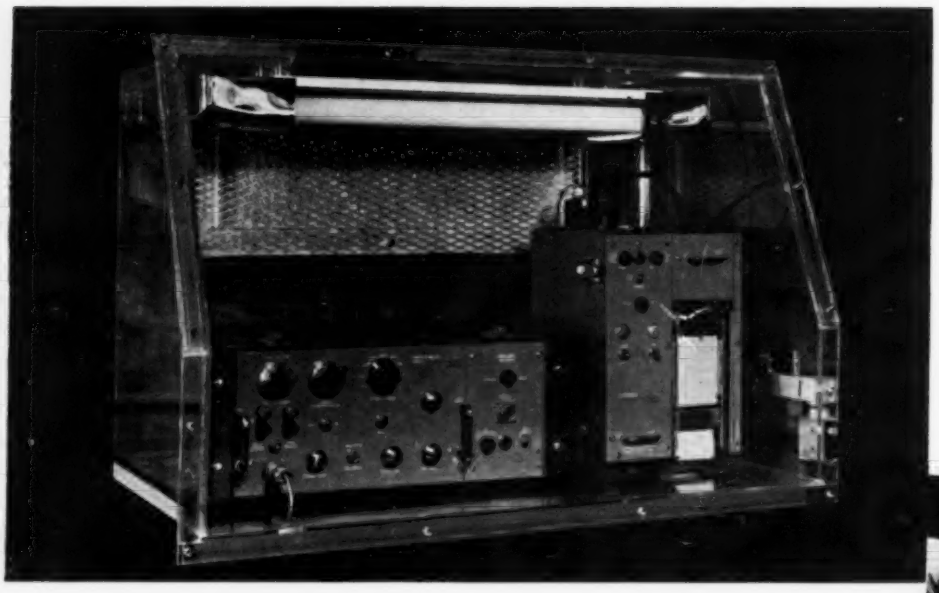
HOT WELDED RAIL GRINDING TAKES OUT CLICKITY-CLACK



A Revolutionary New Way To Evaluate Grinding Wheel Hardness and Uniformity By Electronics

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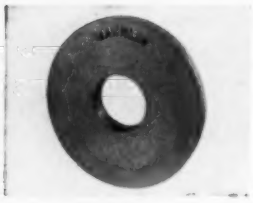
Grinding Wheels by MACKLIN

Developed under the direction of the Macklin Research Department



On May 10, at the Production Engineers' Conference at the A.S.M.E. at Toronto, a paper was presented on a method of scientifically determining grinding wheel hardness and uniformity. It involves using the Dynamometer, illustrated above, to *accurately determine wheel hardness and uniformity across the entire cutting face of the wheel under controlled rotating conditions which simulate actual grinding.*

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Minute amounts of abrasive are crushed from the wheel's cutting surface by a conical, hardened steel wheel which is in running contact with the grinding wheel being tested. The force required to crush these minute amounts of abrasive and bond is electronically recorded on a permanent tape. Any significant variation in wheel uniformity or hardness is recorded on the tape. *This means* Dyna-Graded® wheel characteristics are precisely predetermined *before* the wheel is shipped. This means we can assure you more accurate wheel duplication, order after order. This means better cost control of your grinding operations.

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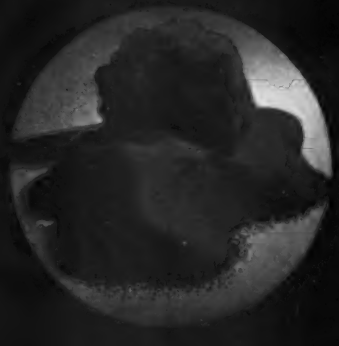

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V8 BOND

. . . a completely new vitrified bond, the product of new materials and new firing techniques. Makes the Ruby Wheel a scientifically predictable cutting tool, always "on grade."

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Time is the measure of productivity

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Reduce grinding time and you increase productivity. Norton's many time saving innovations in varied stages of grinding production can reduce your grinding time up to 30%! The story is a profitable one. Here's why —

Norton Grinding Machines are engineered to permit higher wheel speeds to reduce cutting time. Norton's *Automatic Wheel Balancer* balances the wheel in *five seconds—on the machine.* You reduce time spent "grinding air" up to 85% because of Norton's *Automatic Wheel Contact Accelerator* which speeds the wheel to the work and compensates for work piece-diameter variation. Another advance is Norton's *Automatic Truing* which eliminates work interruptions and the *Automatic Wheel Wear Compensator* that stabilizes the grinding cycle.

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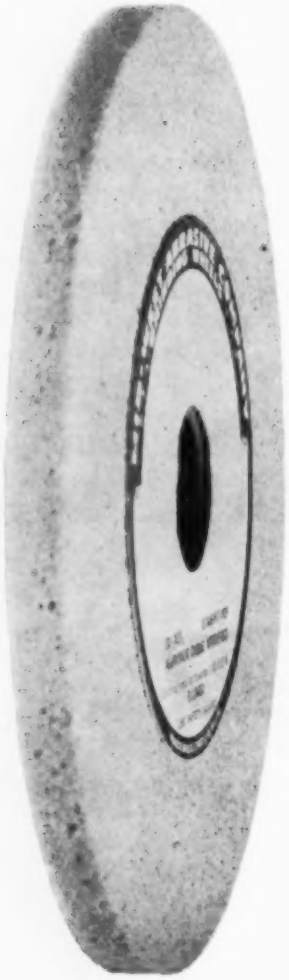

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- Theory of Abrasive Cutting Action
- Grinding the Space Metals
- Jig Grinding Contours

Grinding and Finishing

For Better Production and Finishing with Abrasives

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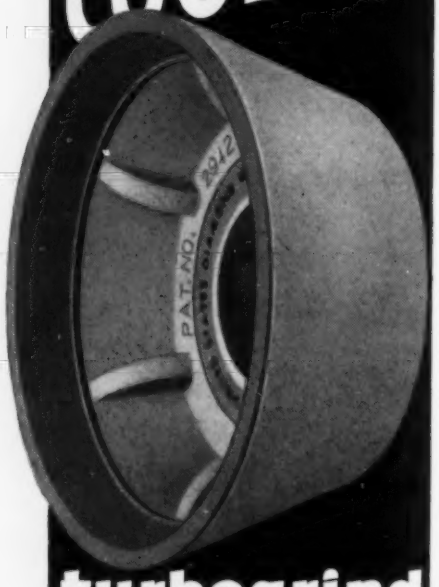

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MORE ON STANDARD WHEEL MARKINGS

MAY—WHEEL STRUCTURE

Friendly criticism, sir, of your picture on page 56, showing the face of a loaded wheel with bits of work material.

Generally, a situation such as this indicates that you have a certain plastic flow of the work and the bond on the wheel at the same time, resulting in impregnation of the periphery of the wheel with melted metal joining itself with the bond. Opening the structure will not necessarily make this better.

Generally speaking, a more friable wheel or a softer grade will eliminate the problem, but opening up the structure is not the method for reducing this flow.

I don't want to be harsh, but I do think the truth is the truth. I hope you will accept this criticism in the light in which it is intended.

We look with great interest and certainly with great appreciation on your efforts in this direction, and we only want to point out that other people may take exception to this also, but not let you know.

R-O Manufacturing Co.
W. A. Johnson, President

Bill Johnson is a friend who is usually quicker with praise than with criticism. Both are straight-forward and pungent—and welcome.

In self-defense it can be pointed out that the article was about structure, and mentioned changing structure as one means of remedying wheel loading, but not the only one.

Any other comments?

JUNE—BOND TYPES

Your fifth article under the title "Standard Marking System for Grinding Wheels" forces me to express myself with this letter. My experience of 20 years gives me a feeling of intense rebellion against the few lines you allotted to the present day usage and development of rubber bonded wheels and still again to present a photo illustrating usage of rubber bonded wheels in a centerless grinding operation as a feed wheel. This application has been one enjoyed by rubber bonded wheels almost since the inception of centerless grinding.

I would more than welcome the opportunity to prepare and submit for your approval an article showing the many new developments and applications of rubber bonded wheels in replacing both vitrified and resinoid bonds.

Pekay Abrasives, Inc.
Nathan Adler
Sales Manager

We would be very happy indeed to review your proposed article. . . .

Such a development could cover in detail the area which was outlined in the June article on standard wheel markings.

The intent of that series was to explain wheel markings in an elementary fashion. For the paragraphs in question, the object was to present in very general terms the method of manufacture and some of the principal applications of each bond. It was not designed as an inclusive discussion of any of the bonds. . . .

No goggles on operator and long sleeves around machinery. (Photograph, p. 36) Not a very good advertisement as far as safety is concerned, do you think?

R. Guilbert, Safety Director
California Subcontractor Division
Avildsen Tools & Machines, Inc.

The comment is entirely correct. Even though the practice as pictured is fairly common in such a situation, it is not in the best interest of safety.

The picture will be replaced in the reprint of the series. . . .

.0002" vibration level vs. .000002" vibration level—that's the difference between commercial and precision balancing with a Stewart-Warner Industrial Balancer. This *big difference* in ability to meet tolerances can make *the* big difference in the quality of your work and in the economy of your operation. By keeping your grinding wheels in precision balance, you'll *save in many other ways* . . . through longer wheel life, fewer dressings, and less rejects.

Precision balance can be obtained right on the grinder—without removing the wheel. The monitor feature warns the operator when vibration exceeds a pre-set amount – before the cut is taken.

Send for free, fully illustrated catalog today describing not only this monitor and balancer but the complete line of Stewart-Warner Precision Dynamic balancing machines.

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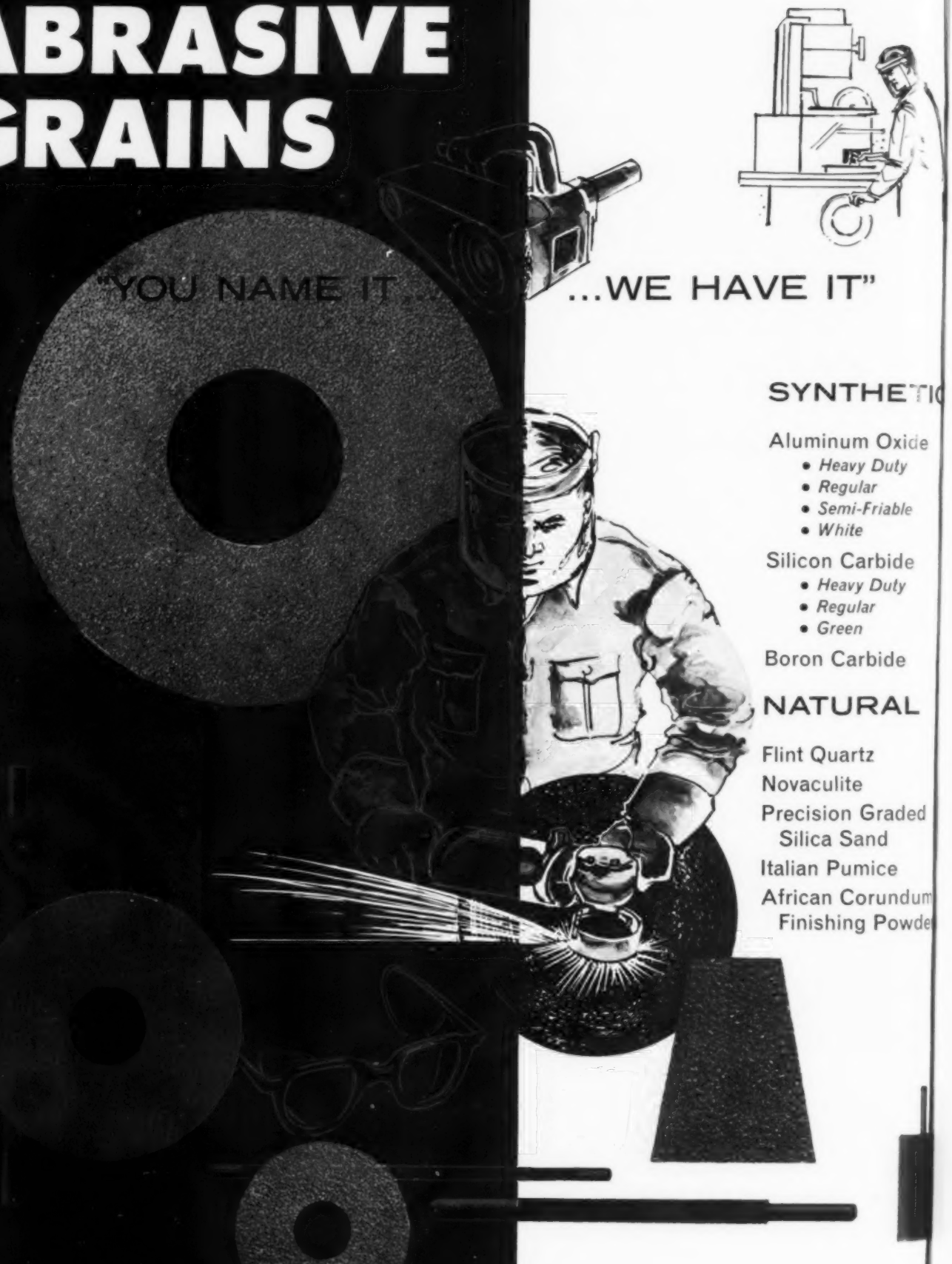

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Dateline: Industry's Economy

The nation's economy advanced at an annual rate of about $12 billion in the April-June quarter. On the basis of past calculations, this would mean that the gross national product reached a record annual rate of about $512 billion in the second quarter. However, the level of the GNP statistics is altered every July on the basis of income statistics which are compiled only once a year. This can result in a variation of plus or minus $2 billion.

Positive depreciation allowance legislation by Congress would become a major force in the advance of the economy, Robert S. Stevenson, Allis-Chalmers Mfg. Co. president, told a meeting of the National Industrial Conference Board in New York City. "If Congress would come through with a piece of really positive depreciation allowance legislation, the machinery industry should not only improve along with general business, but would become a major force in the economy's advance." he said.

Inventories of manufacturing firms have started to rise after having been reduced each month since August, 1960 when a peak level of $55 billion was on hand. Manufacturers' inventories at the end of last May totaled $53.4 billion. The impact of the recent inventory liquidation was felt entirely by the durable goods industries—metals, machinery, vehicles, equipment. The latter still have well over two months' supply on hand though in most instances the inventory-sales relationship had lessened. Sales of manufacturers of both durable and nondurable goods have risen in the last four months from the low levels reached last January.

Plant and equipment outlays should begin to rise in late 1961's second half and hit a new peak of $38 billion during 1962, according to James M. Dawson, vice president and economist, National City Bank of Cleveland, in a study of recent surveys by the Commerce Department and the Securities and Exchange Commission. Dawson found that capital spending is currently at a "cyclical low point" and added that the upward trend "should continue right through 1962 and into 1963, according to the patterns experienced in the three previous postwar recessions."

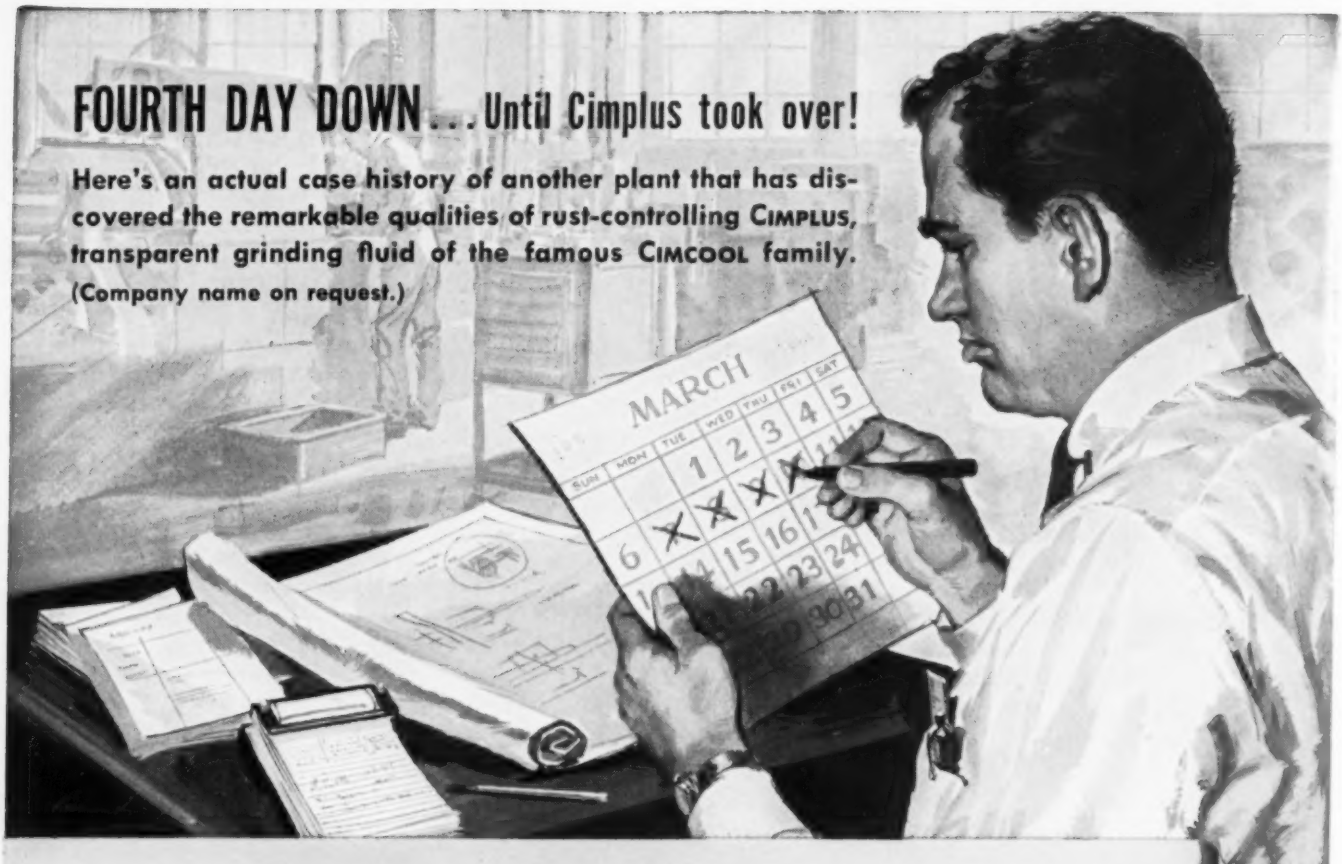
Fifty-two American corporations generated more than $1 billion in sales or revenues in 1960, a compilation by the New York Stock Exchange showed. General Motors Corp. led the list with sales of $12.7 billion, up $11.2 billion from 1959. Four newcomers entered the $1 billion ranks—American Motors, Douglas Aircraft, Sperry Rand, and F. W. Woolworth. Dropped from the list were Armco Steel, North American Aviation, and United Aircraft.

An expansion program costing "several million dollars" for its aluminum rolling mill at Omal, Ohio, was recently announced by the Olin Mathieson Chemical Corp. Expansion of the 2-year old plant is being made to keep up with growing and changing demands of aluminum sheet and plate customers.

Output of the nation's mines, mills, and utilities advanced about 1.5% in June to a level just shy of the pre-recession peak, according to the Federal Reserve Board. The board's index of industrial production advanced nearly two points from May, rising from 108.3 to 110. This means that June output was 10% above the average for 1957, the base year representing 100%.

FOURTH DAY DOWN... Until Cimplus took over!

Here's an actual case history of another plant that has discovered the remarkable qualities of rust-controlling CIMPLUS, transparent grinding fluid of the famous CIMCOOL family. (Company name on request.)



FIELD SERVICE REPORT

The job was grinding cast iron machine tool parts on three rotary surface grinders with an 1800 gallon central cutting fluid system.

The coolant they had been using had let the sludge cake up and clog up the lines and they had been shut down for four days. Then we installed Cimplus at 100 to 1 dilution and the problem was solved.

Since Cimplus took over, they've had no sludge trouble at all. The swarf and grit settles nicely for them, but it doesn't cake. They're also real pleased with the rust prevention on the cast iron parts that Cimplus gives them.

Kent Reece

N. Y. Office

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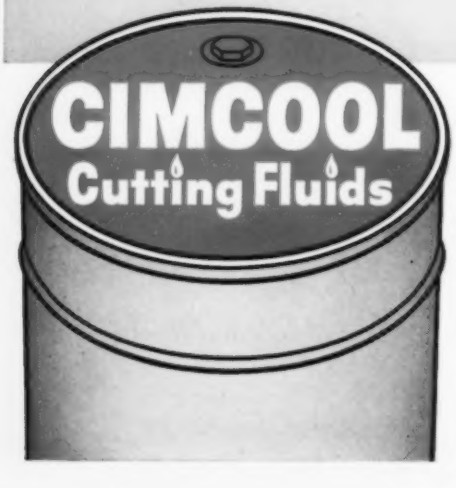

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Metalworking on the move

Canadian Allis-Chalmers has transferred all electrical production from its St. Thomas, Ontario, Canada, plant to its plant at Lachine, Quebec. Reason given was that the complete conversion from steam to diesel electric locomotives for Canadian railways doesn't warrant a separate manufacturing operation. Allis acquired the St. Thomas works in 1950 from the Erie Iron Works to manufacture control equipment for diesel electric locomotives. Other electrical equipment was later added to production.

Easier on the ears is a new automobile muffler made of MF-1, a special stainless steel alloy developed by Allegheny Ludlum Steel Corp. for use in mufflers and anti-smog devices. The special steel is being used in the '61 Thunderbirds and is being evaluated for use on many other '62 models. The muffler is guaranteed unconditionally (except for accident and abuse) for five years and Arvin engineers feel it will last even longer. This is the first time in the industry a stainless steel muffler has been offered to the replacement market. Just one more step in the steady progress of the metal industry.

Silver-lined clouds make a pretty picture, but for America's silver industry the forecast is both cloudy and turbulent. A silver shortage within a year or so is a distinct possibility. World consumption of the metal has consistently exceeded mine production at a rate of roughly 67 million ounces annually over the last decade. Arts and coinage, the traditional markets, have already been overtaken by industrial uses and this situation is likely to continue. The automotive and appliance industries will be feeling the shortage. They need silver for solder and brazing. Their consumption now is more than 24 million ounces annually and rising.

Up from Down Under comes a report that numerous opportunities for sales, investment, and expansion of America's metalworking industry are available in Australia. This is the conclusion highlighting a survey and analysis of the Australian field made by Philip R. Marsilius, executive vice president of the Producto Machine Co., Bridgeport, Conn. A review of imports of metal products indicated toothy gaps in Australian manufactures, including such items as tool steel-specialty steels, special tools, metal cutting and forming machine tool accessories, and many others.

Private investment in manufacturing facilities abroad benefits the U.S. economy and contributes substantially to domestic employment. Moreover, such foreign business activity strengthens the execution of American foreign policy and tends to improve our international balance of payments. These and other findings appear in an extensively researched report filed by the Machinery and Allied Products Institute with the House Ways and Means Committee. One company, cited in the report, found that 11% of its employees in the U.S. owe their jobs to the firm's foreign operations.

A happy marriage of a Cincinnati research and development firm, RAD, Inc., with Commercial Filters Corporation of Melrose, Mass., has been recommended by directors of both firms. In announcing the merger, Michael F. Schaible, RAD president, said it would bring together technological skills and financial backing in two great areas of promise in the filtration field—research and development. He declared that filtration "is an exciting and growing industry that certainly needs additional research and development."

The Aluminum Co. of Canada announced plans to build a $10.9 million steel mill at Kingston, Ontario. First output from the new mill will be available in about 18 months. It will double Alcan's sheet capacity to 60,000 tons a year.

If steel products "aren't worth more to our customers than they cost, we can't stay in business," Marcus J. Aurelius, U.S. Steel Corporation's administrative vice president, told members of the National Association of Purchasing Agents. "We must pay attention to far more than the functions of materials—if we are to preserve the freedom of action and initiative which makes it possible for us to improve our materials," he added. "We must be as devoted in perfecting the function of ideas as we are in perfecting the function of materials."

HOW MICRO SWITCH FINISH GRINDS SMALL PARTS TO .0001"

Van Norman Centerless Grinders meet rigid design limits of famous precision snap-switches at high output-rate

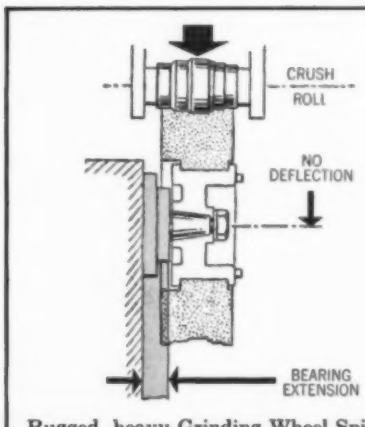
Close tolerances in vital parts are indispensable to MICRO SWITCH, suppliers of over 12,000 types of precision switches to home, industry, defense. This division of Minneapolis-Honeywell Regulator Co. gets accuracy and economy with VN Grinders.

.0001" on Thru-Feed—.0002" on infeed are met by VN units in volume-grinding actuator shafts and plungers for snap-action switches. Specs for multi-diameter concentricity and micro-inch finish are continuously held at high outputs (1,000 to 2,000 parts per hour on thru-feed; 120 to 250 on infeed).

Fast, Smooth, Vibrationless Operation is designed into VN Centerless Grinders. Massive Construction—well-coordinated components—lifetime-sealed spindle units. Result: strict control over work deflection . . . no warm-up, no chatter, no "creep." VN hyd. profile diamond dressing on both wheels, with cams for straight or multi-diameter parts.

Variable Speeds, Easy Set-Up, Operation Control. Two regulating wheel speed ranges: 13–80 and 140–830 RPM. Capacity 0–1½" dia. Optional: VN Crush Dressing Attachment.

Free Booklet.—"Centerless Grinding" —valuable guide to high production, lower costs. For your copy, contact factory or your local distributor.



Rugged, heavy Grinding Wheel Spindle with its additional bearing extension withstands the terrific pressures of crush roll forming with NO DEFLECTION.

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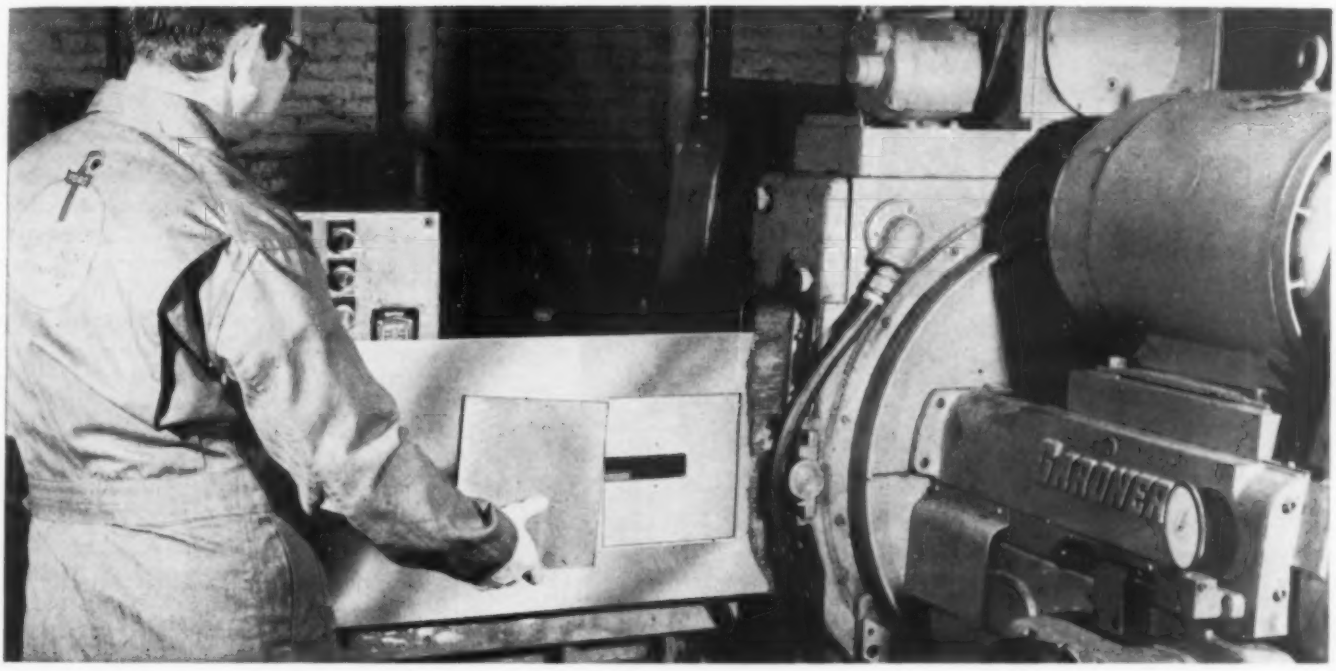
Design for Grinding

RICHARD L. McKEE • Managing Editor



Aluminum plate is loaded into gun type fixture for grinding in a Gardner 2H30 double disc grinder.

One double disc grinder 10 X 8 milling machines

Aluminum plates and brass cams are now ground with reduction in production time of from 2 hours to 1 minute and 2 days to 3 hours. A double disc grinder easily and quickly paid for itself while providing higher production.

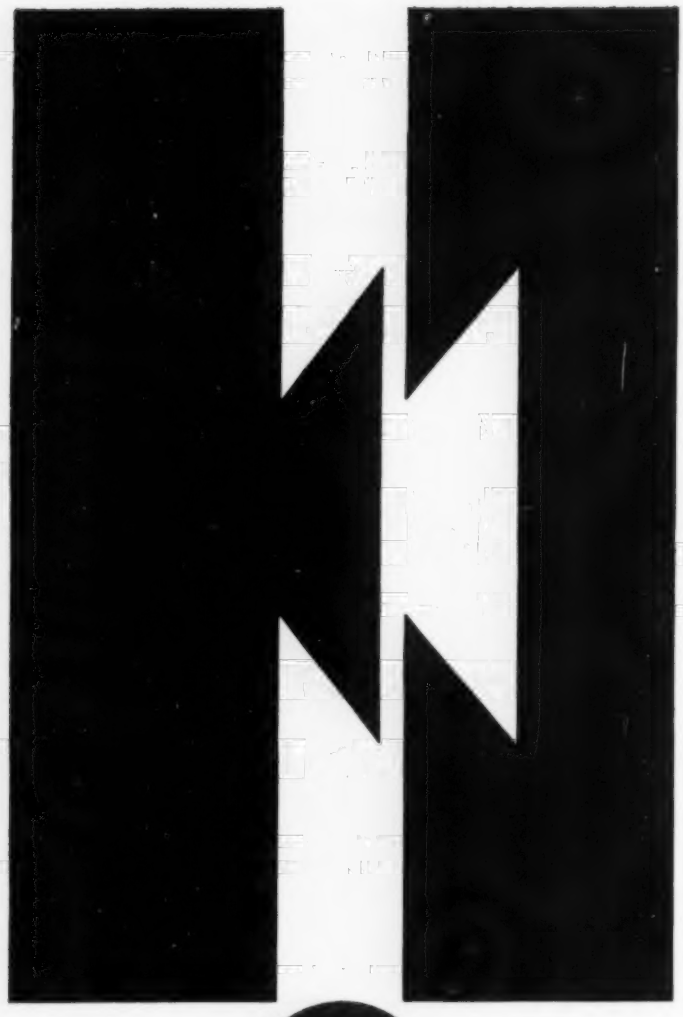
Assortment of parts which are now precision ground by Ford Instrument Co. on the double disc grinder.

● It took the first big order to convert the finishing of aluminum plates from milling to double disc grinding at Ford Instrument Co., a division of Sperry Rand Corp., Long Island City, New York.

But once they started to grind the plates, they found they had . . .

A production rate equal to ten times the rate on eight milling machines, with a unit time of less than a minute rather than 2 hours; An "unbelievably" low reject rate: Better accuracy; and enough extra machine time to pay for the grinder "several times over" in 18 months on only one other application.

continued



FOR CRITICAL TOLERANCES AND PRECISION GRINDING

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Don't risk expensive piece parts of exotic metals or ceramics with a "good enough" diamond wheel! Insist on Elgin Diamond Wheels for top performance based on uncompromising production standards and guaranteed diamond content.

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ONE DOUBLE DISC GRINDER = 10 TIMES 8 MILLING MACHINES

continued

The aluminum plates which started all this are walls for a gear box to house components in the computer that launches and guides the U.S. Navy's Tartar and Terrier missiles. The plates must be flat and parallel within .003". They are 3/16" thick, and can be as large as 14" x 18".

When Ford first began making the gear boxes on a limited scale, the smoothing and thinning of the plates was done with a fly-cutting tool on a milling machine. With the first quantity order, however, the required milling time of about two hours per plate was out of the question.

Double disc grinding, with both sides of the plate ground simultaneously, was a promising solution. In addition to the obvious reduction in processing time, this change has greatly increased accuracy of the finished part and has practically eliminated rejects.

Set-up time has been reduced to the few seconds required to load the work in the blade of a roller gun type fixture.

To develop the best operating procedures. Ford worked closely with the machine builder, Gardner Machine Co., Beloit, Wisconsin. The operation went through an experimental period for determining the right disc specifications, the best wheel dresser, the coolant, and the proper disc alignment.

Once these were worked out, however, double disc grinding proved so efficent that it has become standard operating procedure for similar jobs on which flatness and parallelism are critical.

One example is the grinding of brass cam masters. Formerly, it took a skilled technician about two days to hand-scrape the master cam, face it, and check it. The grinder turns one out in about three hours.

Savings on this operation, on which about 2,000 cams and master cams were produced over a period of 18 months, are reported to have saved several times the cost of the grinder.

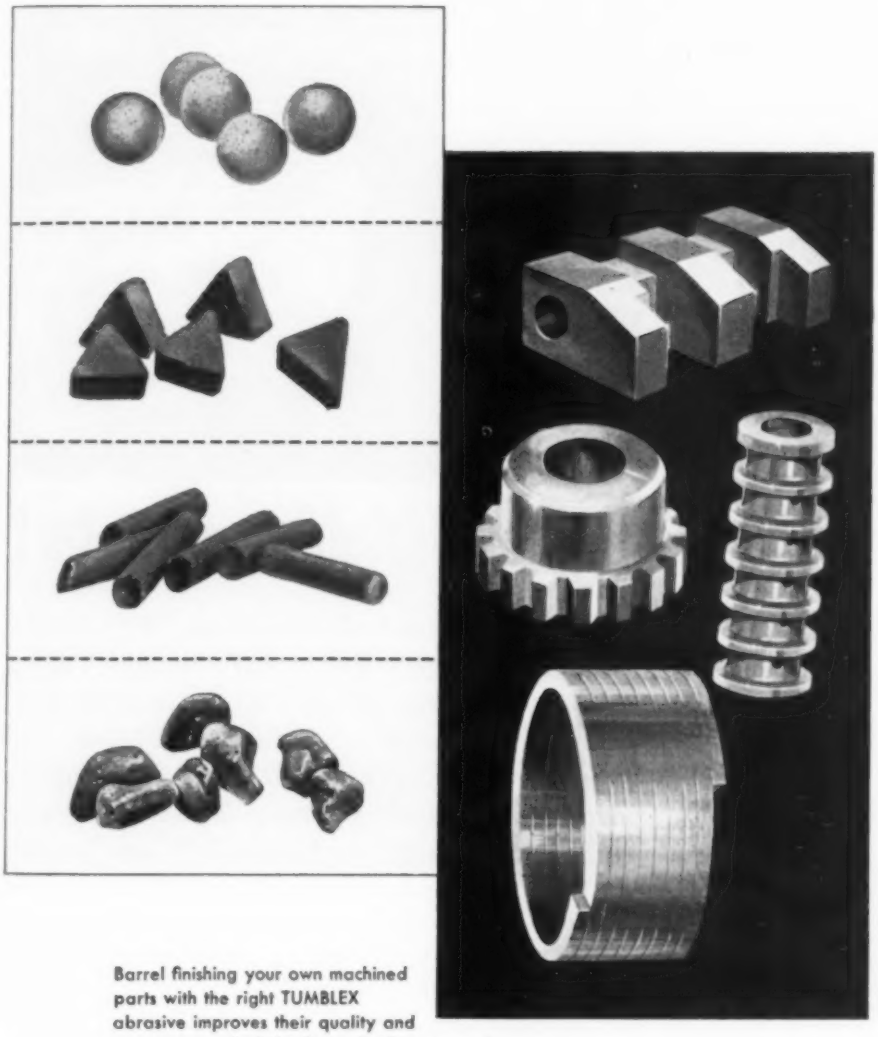
• • •

Barrel-finishing is best finishing

to cut costs of your machine parts

It's common knowledge that barrel-finishing is now the one outstanding way to cut costs and improve the appearance of mass-produced parts.

If you're missing these production advantages because you've felt your own particular machined parts may be too delicate and complicated . . . too big and heavy . . . or not the right material . . . this message is for *you!*



Barrel finishing your own machined parts with the right TUMBLEX abrasive improves their quality and appearance. And this faster finishing can cut your cost-per-piece produced.

The fact is that barrel-finishing with Norton TUMBLEX* abrasives is your surest, quickest way to remove burrs, provide uniform radii, improve surface finish and increase the fatigue strength of the parts *you* are machining.

The variety of materials, sizes and shapes covered is practically unlimited. Materials include ferrous, non-ferrous, and modern space alloy metals — also plastics and many other non-metallics. In sizes, anything from tiny roller bearings to aircraft wing spars can be handled. And shapes can be the most complicated ever processed.

For your product's eye-appeal, barrel-finishing provides excellent finish. Lower handling costs are assured by the barrel-finishing ability to combine several operations — deburring, breaking sharp edges, surface finish refinement, etc. — at the same time. In addition, your barrel-finished machined parts can be plated without burnishing or buffing — and welded or brazed after simple cleaning.

Get complete proof. Send sample parts to our Sample Processing Department. We'll barrel-finish, return samples and report the methods and abrasives you need for new production advantages. NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

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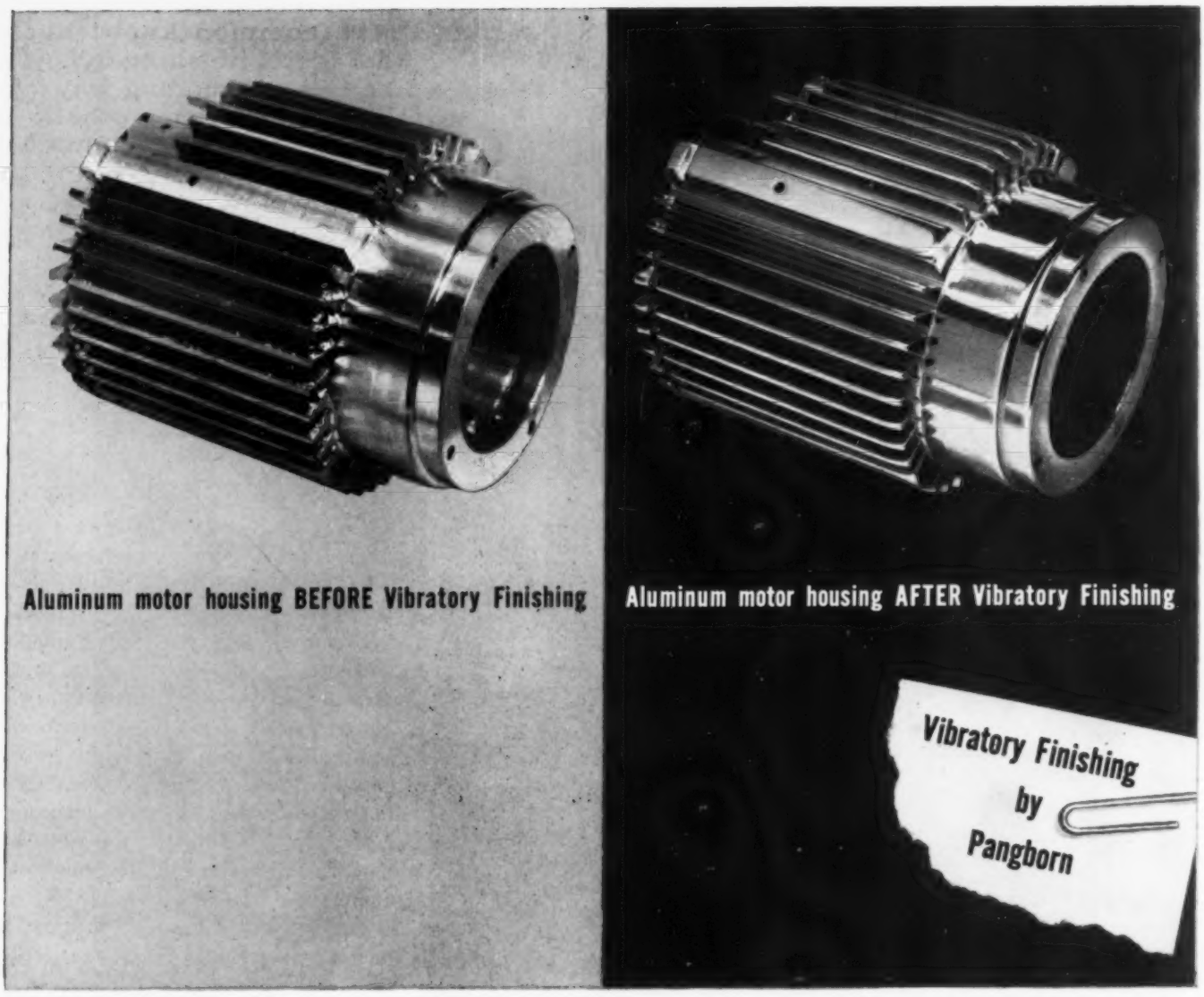
Aluminum motor housing BEFORE Vibratory Finishing
Aluminum motor housing AFTER Vibratory Finishing
Vibratory Finishing by Pangborn

Amazing, how inexpensive complex finishing can be!

In some cases, the Pangborn Vibratory Finishing Machine has reduced finishing time by over 90%. You know what this means in time and labor savings alone. Especially since this machine tackles complex finishing assignments with the same ease and speed as simple ones.

Its uses are amazing, too. It descales, deburrs, burnishes, radiuses, fine-finishes. It handles a wide variety of materials . . . metals, plastics and ceramics. And this machine tackles complex and difficult jobs impossible or impractical to do by other methods . . . and does them quickly and economically.

The exclusive air-cushioning system built into every Pangborn Vibratory Finishing Machine provides better and closer amplitude control and offers automatic adjustment for any weight load. Air-cushioned floor mounts eliminate any transmitted vibration. No special foundations are necessary. Variable speed controls available on all models. Automated and auxiliary equipment, media, compounds for every need. Send parts with exact finish specifications or finished specimen for sample processing in our laboratory to Mr. William Brandt at:

PANGBORN CORPORATION, 820 Pangborn Blvd., Hagerstown, Md., Pangborn Canada, Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada—*Manufacturers of Vibratory Finishing, Blast Cleaning, Dust and Fume Control Equipment; Rotoblast® Steel Shot and Grit©*

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Abrasive Engineer's Corner

ARTHUR RAKESTRAW • Contributing Editor

WEAR IN CENTERLESS GRINDING WHEELS

• On our Cincinnati No. 5 centerless grinder, we have problems in using wheels below 20″ in diameter. Are we trying to do the impossible, or is there something we should be able to do?—R. B. W., Greenville, South Carolina.

Although you mention a No. 5 Cincinnati centerless, I believe that this is a No. 3, which mounts a 24″ wheel.

Your experience in the operation of this grinder is not unusual when wheels have worn to 20″ diameter or smaller. The reason for the difficulty is the softer action resulting from the loss of peripheral speed. Assuming that an original 24″ wheel (1043 rpm) operates at 6500 sfpm, its surface speed would be reduced to approximately 5425 rpm at 20″ diameter.

The loss of over 1000 sfpm causes the wheel to act considerably softer than at its original mounting—about equivalent to the loss of one grinding grade.

Users who have both the Cincinnati No. 2 and the No. 3 centerless grinders do not experience quite as much difficulty. When the 24″ wheels have worn to 20″ on the No. 3, they are remounted on the No. 2 and operated at 6,500 sfpm. Where only the No. 3 is available, wheels must be used to final stub size before being discarded.

Zoned wheels will at least partially solve the problem. These wheels are designed in a given grade from the 24″ diameter to the 20″ diameter, and one grade harder from the 20″ diameter to the hole. The increase in wheel hardness somewhat offsets the rapid wheel wear. This is not a cure-all, but it helps.

STANDARD FINISHES?

• Our company is interested in establishing finishes which are comparable to the standard finishes now used in the abrasive industry. Can you possibly furnish us with a sample chart of these finishes?—M. E., Rochester, New York.

There are no standard finishes in the grinding wheel industry. Such terms as "commercial finish" have long since been replaced by definite rms (root mean square) designations.

You may possibly have in mind the finishes adopted by the stainless steel polishing industry to designate the various steps in the refinement of stainless sheet surfaces. These standards do not apply to any other sheet; they are limited to stainless.

The finish numbers which have been adopted are as follows:

No. 1. Stainless steel sheet as originally rolled, annealed, and pickled. Color is dark gray and black.

No. 2D. Cold rolled before annealing and pickling. Dull in color, but an improvement over No. 1.

No. 2B. Additional cold roll passes make the finish bright.

No. 3. Polished by 36 grit aluminum oxide belts, the 50, 60, or 80 grit aluminum oxide to remove pits and slivers. This is followed by several passes with 100 grit aluminum oxide. Deep and definite grain pattern.

No. 4. Improved No. 3 finish. Several passes with 120 grit A10 followed by 150 grit silicon carbide belt. Finish blue.

No. 6. Polish No. 4 with 180 grit SiC belt, followed by tampico polish or brushing.

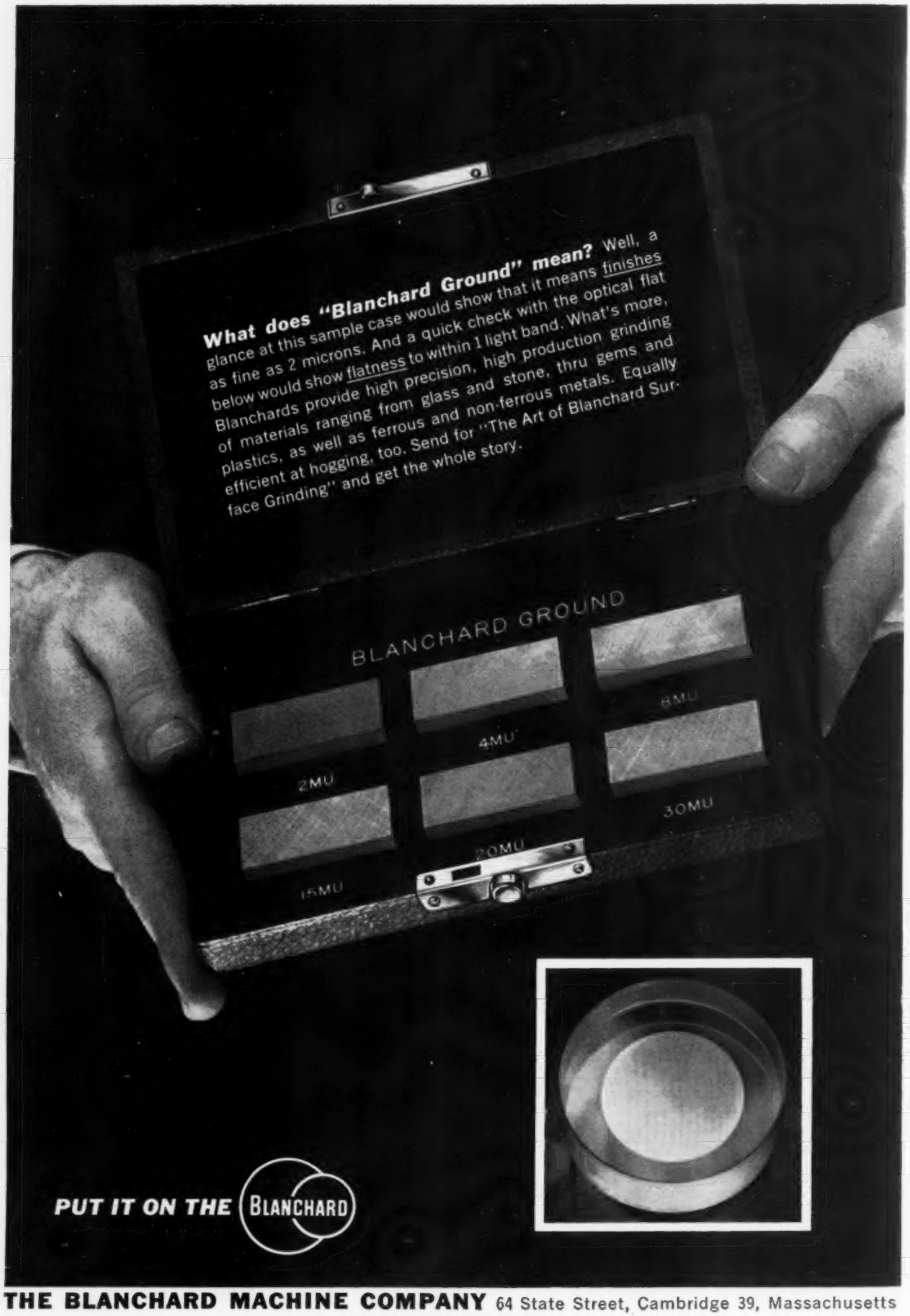
No. 7. No. 6 finish improved by polishing with 240 and 280 SiC belts and buffing with cloth and rouge.

No. 8. Finish further improved by polishing with 320 grit SiC belt, then buffing with cloth and rouge. This produces a mirror finish.

I understand that the different steps which are designated by the numbers are standard throughout the stainless industry.

Undoubtedly you will experience some difficulty in assigning standard finish numbers by visual inspection. In order to facilitate your evaluation of finishes, I'd suggest that you obtain from some supplier of stainless steel sheet samples representing the different stages through which the sheet progresses. These can be used in becoming acquainted with the several designations. • • •

"Just where did you learn to dress grinding wheels?"


What does "Blanchard Ground" mean? Well, a glance at this sample case would show that it means finishes as fine as 2 microns. And a quick check with the optical flat below would show flatness to within 1 light band. What's more, Blanchards provide high precision, high production grinding of materials ranging from glass and stone, thru gems and plastics, as well as ferrous and non-ferrous metals. Equally efficient at hogging, too. Send for "The Art of Blanchard Surface Grinding" and get the whole story.
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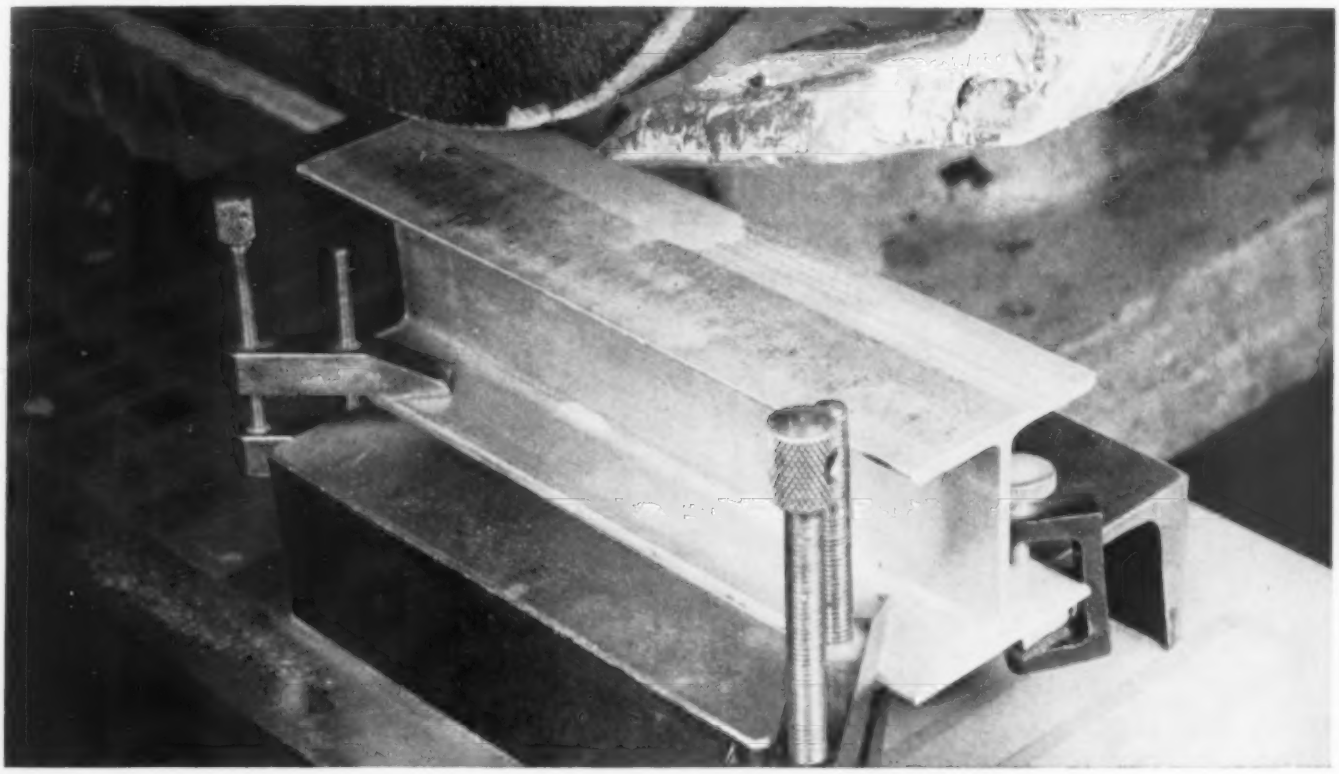
CHANNEL IRON HOLDS NON-FERROUS WORK ON CHUCK

By H. J. Gerber



A piece of ordinary structural channel, surface ground to accurate parallelism, makes a handy accessory for the surface grinder. Many kinds of non-ferrous work may be clamped to the channel.

EMERGENCY COOLANT FILTER

By John Davies

• Occasionally we find it necessary to cylindrical grind an exceptionally fine finish on certain experimental jobs. Our grinder is not equipped with a coolant filtration unit and we find that a settling tank alone is not adequate to remove finely suspended swarf particles from the coolant. It is well known that these small metal particles will be the cause of microscopic scratches on the finish of the work so we make use of the illustrated emergency filter.

A small cloth bag is packed with cotton waste or wadded cheesecloth and tied around the coolant spout. The packing material should completely surround the spout opening so that all coolant will have to pass through this material.

This method is effective if used for only short run jobs and may become ineffective after about 30 minutes use.

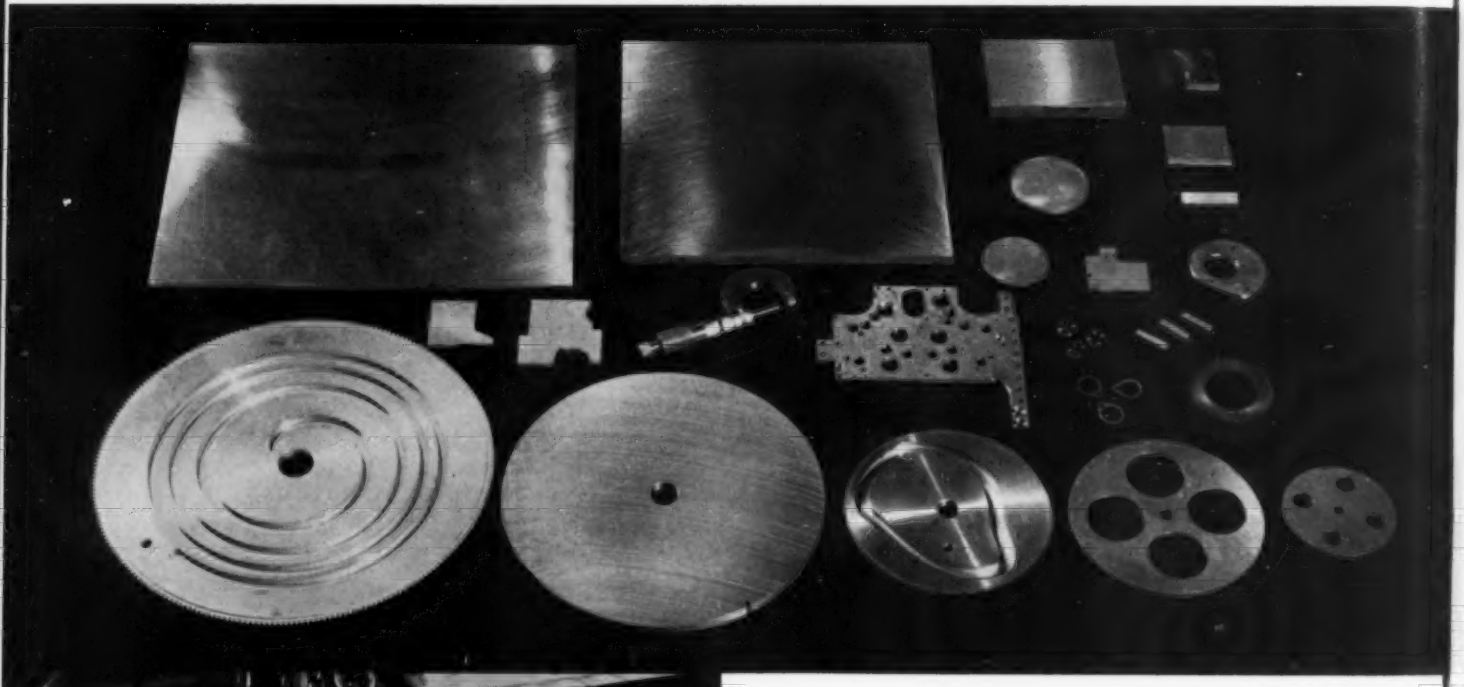
• • •

An old idea re-styled, for the occasional precision job that must be done on a grinder normally used for routine work.

NO DOWN TIME FOR DISC CHANGE

in grinding all these jobs

Single Gardner disc specification grinds complete range of precision parts... saves time and costs for Ford Instrument Company



Gardner abrasive specialist developed this disc specification to grind all parts, eliminating down time for disc changing. Photos courtesy of Ford Instrument Co., Div. of Sperry Rand Corp.

GARDNER

GARDNER MACHINE COMPANY, BELOIT, WISCONSIN
subsidiary of Landis Tool Company

Rights--Obligations

In this country we have a lot of rights which are guaranteed to us by law and backed up by the constitution. This is why we prefer our type of government to any other. It is the reason we have grown to be the leading power in the world in less than 185 years. It is the reason we have a standard of living higher than the world has ever known.

Yet, we seem to be throwing away our rights either by default or by shortsighted selfishness. We can all sight a number of glaring examples but what affects you as the reader and we as the editorial staff is the short sightedness of companies which hide developments behind the guise of proprietary rights!

Our editorial staff has visited many plants where we have been shown operations but told not to repeat them because of their "proprietary rights." This is a plain case of the head in the sand. A progressive company will look upon any development as a step to the next. Thus, if they have found the development successful and are applying it, they are ahead of competition and by the time competition has read about it they will have progressed beyond the announced development.

We have a policy of checking all story material with the source for technical accuracy and implication. We steadfastly resist the temptation to become a technical scandal sheet. But, when companies do not attempt to fulfill their obligations to have the right to proprietary privileges, it is extremely difficult. We detest "yellow journalism" as it does not fulfill the obligation for the right to freedom of the press. Yet, if source material is withheld through selfish reasoning, the other side is not living up to their obligations and are equally guilty.

This issue goes further than journalistic controversy. Under Communism there is no "proprietary right." Information must be passed on just as soon as possible to all who can benefit. We are in a conflict with this system. Our obligations do not end with fighting for the country, signing the declaration, voting or being active in civic organizations. If we expect to hold on to our rights to freedom, we must defend it in every way—everyday.

M. W. Patterson

Editor, Grinding and Finishing

Jig grinding: versatility in the die shop

Jig grinding for holes and contours in hardened materials has revolutionized some of the basic concepts of tool and die making. First of two basic discussions of this versatile grinding process covers principles, hole and taper grinding.

By FREDERICK C. VICTORY • chief engineer • Moore Special Tool Company, Inc.

PART I

The jig grinder may well be the most versatile grinding machine in the shop. It was originally designed to position and grind cylindrical and conical holes in hardened materials. It is now used, in addition, for internal form grinding of contours, plus some surface and OD grinding applications, Primarily a toolroom unit, it has also found its way into production applications.

With the jig grinder, mating parts of dies can be finished concurrently and made to figures rather than just "to fit." By grinding off the few thousandths of decarburized skin resulting from hardening, it assures greater service life. Its ability to grind holes and enclosed contours permits wider use of solid pieces, with greater economy and strength.

A jig grinder might be very roughly described as a jig borer with a grinding head. All the measuring and positioning portions of the machines are identical. Both machines are of the vertical spindle type. The grinding wheel can be compared to a tool bit held in an outfeed boring chuck.

Two considerations, however, distinguish the jig grinder: the ability to outfeed the wheel accurately while grinding, and the ability to grind tapered holes. These features alone preclude the idea of converting a jig borer to an efficient jig grinder by the mere addition of a grinding spindle. Additional refinements in the grinder have still further sharpened the line of demarcation between the two machines.

Hole positioning and finishing in hardened steels and carbides was one of the original purposes of the jig grinder, and remains its largest application.

Diameters may range from .015″ to 9″, though 90% are estimated to be between .030″ to 3″. Such a variety of sizes could require a wide spread of spindle speeds, except for two limiting factors. For one, the theoretically ideal speed of 6,000 sfpm actually has a wide tolerance within which efficient grinding can be performed. For the second, experience has shown that for holes below 3/16″ diameter a diamond-charged mandrel is more efficient than a wheel, because of the hardness of the abrasive and greater rigidity. The mandrels operate best at a speed approximately one-quarter that of an equivalent wheel, removing the need for extremely high spindle speeds in the smallest diameters. As a result, a speed range of 12,000 to 55,000 rpm takes care of most requirements.

Setting Up the Workpiece

Setting up work for jig grinding involves two or three special considerations because it is a finish grinding operation.

For instance, work needs to be clamped only enough to prevent displacement during grinding, to avoid further distortion of the workpiece.

Good boring practice leaves a minimum of stock for grinding. Hence, if two or more locations must be ground, a certain amount of juggling is required to insure cleaning up all surfaces within dimensional limits.

The dimensional pickup of work for jig grinding is a matter of deciding where to locate the piece so that all existing errors can be corrected in grinding to size. This step of "mapping the campaign" is extremely important.

Failure to take some pertinent factors into account may result in the operator's unhappy discovery that the last hole will not clean up. These factors are:

1. Favor that existing location of small holes rather than larger ones. There generally is less

Jig grinder installation at Harig Mfg. Corp., Chicago. The newest of the eight Moore grinders is at the left.

stock left in small holes, and they are more difficult to move.

2. It occasionally pays to orient the workpiece to favor the holes, even where the edge has been ground. The edge can be reground if necessary.
3. In orienting contours, favor the existing location of sections which present the more troublesome grinding problems.
4. All orientation is directly related to the amount of stock left for grinding. A quick check on the existing size of each hole or contour is often a worthwhile precaution, particularly for work having numerous holes or complex contours.

It is often convenient to be able to gage the bottom of a hole, and the work should be set high enough for this on supports or parallels. The 3″ dimension of parallel setup blocks is usually adequate.

Grinding Holes

Hole grinding requires a combination of three motions: the high-speed rotation of the grinding wheel held in the grinding head; slow, planetary rotation of this grinding head axis; and a vertical, reciprocating movement of this entire planetary action through a range determined by the length of the hole.

Stock removal with an abrasive wheel can be accomplished by either outfeed grinding or plunge grinding.

In outfeed grinding the wheel is fed radially into the work a few "tenths" at a time, cutting with the periphery of the wheel. This technique is generally used when there is but a small amount of stock to be removed and when highest finish as well as accuracy in sizing is required.

In plunge grinding, the grinding wheel is set radially to cut the desired diameter and is fed directly into the stock axially, to cut with the bottom edge of the wheel. Stock can be removed rapidly by this method. For example, a 1″ hole can be opened up by 1/16″ in a single pass at a rate of approximately five minutes per inch of workpiece thickness.

Combining these two methods—roughening to within a thousandth or so by plunge grinding and sizing by outfeed grinding—results in maximum efficiency and high accuracy.

Wheel Selection

Suitable wheel choice is the key to satisfactory grinding performance. Attempting to adapt wheels recommended for internal grinding may reduce the efficiency of the jig grinder by 50%. Continuous research and periodic user surveys have resulted in a chart of recommendations (p. 25) for wheels best suited for jig grinding operations on all materials ordinarily encountered. An inventory of all wheels listed on this chart is maintained for user convenience.

Shank or mandrel length should be proportionate to the depth of the hole to be ground. In this way the wheel is rigidly supported as close as possible to the grinding spindle nose. Frequently it pays to cut down an unnecessarily long shank with a hacksaw to attain this condition.

Wheel diameter should be approximately three-fourths that of the hole. In large holes this ratio must, of course, be reduced.

For shouldered holes the wheel must be small enough to clear the shoulders. A slightly concave dressing of the bottom of the wheel is recommended for shoulder grinding, for if the wheel does not clear the shoulder, the bottom of the hole will not be flat.

Wheel Dressing

Proper wheel dressing is equal in importance with wheel selection. A carelessly dressed wheel produces poor

continued

Basic hole grinding set-up, with abrasive wheel.

Small-hole, contour grinding with diamond mandrel.

finish, out-of-round holes, unintentional taper or bellmouth; locational errors, or surface burn.

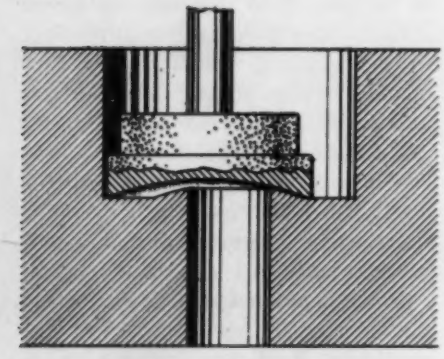
Proper dressing requires only a minute or two longer. It includes the following steps:

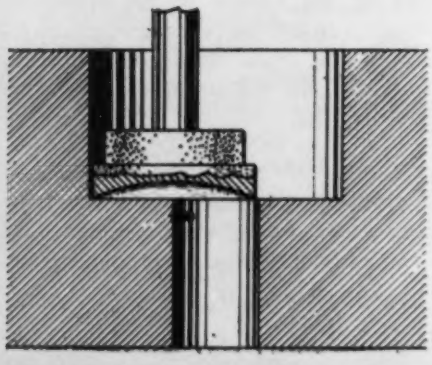
1. Running the wheel at a reduced speed, dress the bottom face and top surface, including any cement around the shank, with a silicon carbide stick held by hand.
2. Before increasing speed, dress the diameter clean, with a sharp diamond.
3. Repeat steps 1 and 2 with the wheel running at operating speed.
4. Relieve the upper portion of the diameter a few thousandths, leaving approximately ¼" of cutting face.
5. For grinding a shoulder or bottomed hole, dress the bottom of the wheel slightly concave with a silicon carbide stick.

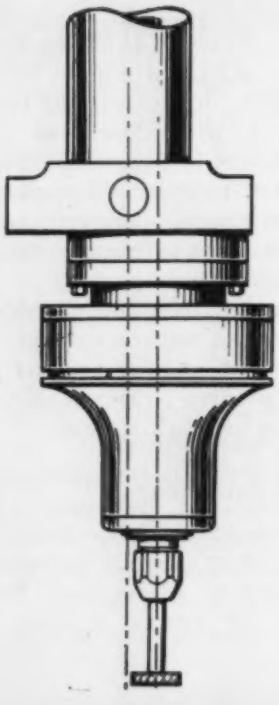
This procedure develops the best cutting characteristics of the wheel. In outfeed grinding only the diameter needs to be re-dressed periodically. In plunge grinding, the bottom surface of the wheel should also be cleaned at intervals with a silicon carbide stick.

Grinding Tapers

The jig grinder can be set to grind taper in either direction. Ordinarily the setting is sufficiently accurate as read in degrees on the taper-setting

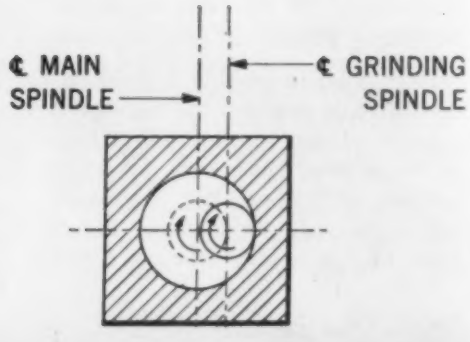


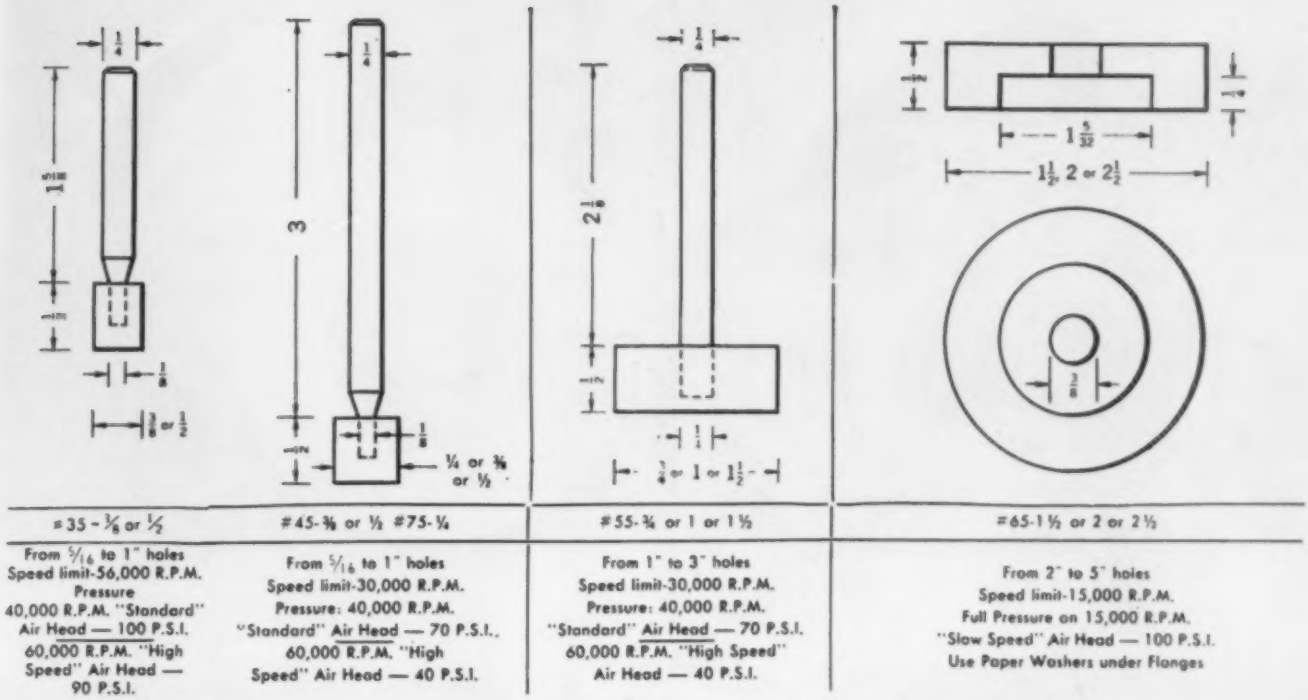




Too large a wheel (upper left) will not grind shoulder flat. It must clear opposite side of hole (lower left)

High-speed pneumatic grinding spindle (middle) adjustably offset from main spindle. Planetary rotation (below).




#35 - 3/8 or 1/2
From 5/16 to 1" holes
Speed limit-56,000 R.P.M.
Pressure
40,000 R.P.M. "Standard" Air Head — 100 P.S.I.
60,000 R.P.M. "High Speed" Air Head — 90 P.S.I.
#45-3/8 or 1/2 #75-1/4
From 5/16 to 1" holes
Speed limit-30,000 R.P.M.
Pressure: 40,000 R.P.M.
"Standard" Air Head — 70 P.S.I.,
60,000 R.P.M. "High Speed" Air Head — 40 P.S.I.
#55-3/4 or 1 or 1 1/2
From 1" to 3" holes
Speed limit-30,000 R.P.M.
Pressure: 40,000 R.P.M.
"Standard" Air Head — 70 P.S.I.
60,000 R.P.M. "High Speed" Air Head — 40 P.S.I.
#65-1 1/2 or 2 or 2 1/2
From 2" to 5" holes
Speed limit-15,000 R.P.M.
Full Pressure on 15,000 R.P.M.
"Slow Speed" Air Head — 100 P.S.I.
Use Paper Washers under Flanges

Section from chart of recommended grinding wheels for Moore jig grinders.

plate. However, when a precise angular setting is required, it is advisable to transpose the information into thousandths taper per inch.

The actual technique of taper grinding varies with the type.

Grinding a full-length taper is done in the same manner as for a straight hole, except for the original setting of the wheel. After the taper has been set and the wheel dressed, the wheel is retracted to clear the lower edge of the hole and carefully entered. The wheel should be stopped during entry.

Spin the wheel by hand and outfeed it gradually until it makes brushing contact with the bottom corner of the hole. Then back it off about .002″ on the outfeed dial before starting the spindle.

When a hole is partly straight, partly tapered, common practice is to grind the straight hole first, then the taper. Sometimes, when the hole is small or difficult to observe, it is more convenient to grind a taper to the top and then grind the straight hole.

Grinding Small Holes

Holes less than 3/16″ diameter cannot be ground efficiently with a conventional abrasive wheel. For these, a diamond-charged mandrel is preferred. In these diameters, too, length of hole in relation to diameter is important; a ratio of 6:1 (length six times diameter) is regarded as the practical limit.

During grinding the best results are secured if a constant and uniform pressure is maintained between the mandrel and the work.

The following "tricks of the trade" should prove helpful in small-hole grinding:

1. Uniformly graded diamond powder should be used. Holes up to 3/32″—80-100 grit; over 3/32″—60-80 grit.
2. Avoid bellmouth by preventing the mandrel from leaving the hole at either end.
3. Avoid introducing a freshly charged tool as a hole nears size, since it will cut much more rapidly than a worn mandrel.
4. Do not permit the uncharged shank of a mandrel to contact the work. Frictional heat will burn both the work and the mandrel. The work, partially annealed at the point of contact, will charge with diamond dust and probably be ruined.
5. It is generally more economical and efficient to make a new mandrel for each job. At a cost of a few cents per mandrel use of an old one or using time to match one to the requirements can hardly be justified.
6. Because mandrels cannot be trued, it is necessary to measure both top and bottom of a hole while grinding, to avoid a ridge. The work should be set on parallels of sufficient height to make this possible.

General Hole-Grinding Practices

1. Lock the machine travels securely before grinding.
2. Rough all holes before finishing any of them. This is an excellent precaution against setting errors. Where highest accuracy is required, allow work to cool to room temperature before finish grinding.
3. Avoid grinding excessively long holes. Cooperation of the designer may permit a portion of such holes to be relieved.
4. A wood wheel turned from maple and rolled in fine lapping compound will finish without materially altering size.
5. Avoid attempting to finish a hole with a glazed wheel, even though within a tempting "tenth" of size.
6. Demagnetize the work before setting up.
7. Keep wheels freshly dressed when grinding thin sections. A glazed wheel will cause heating, distortion, and locational error.

• • •

(Conclusion of this series next month.)

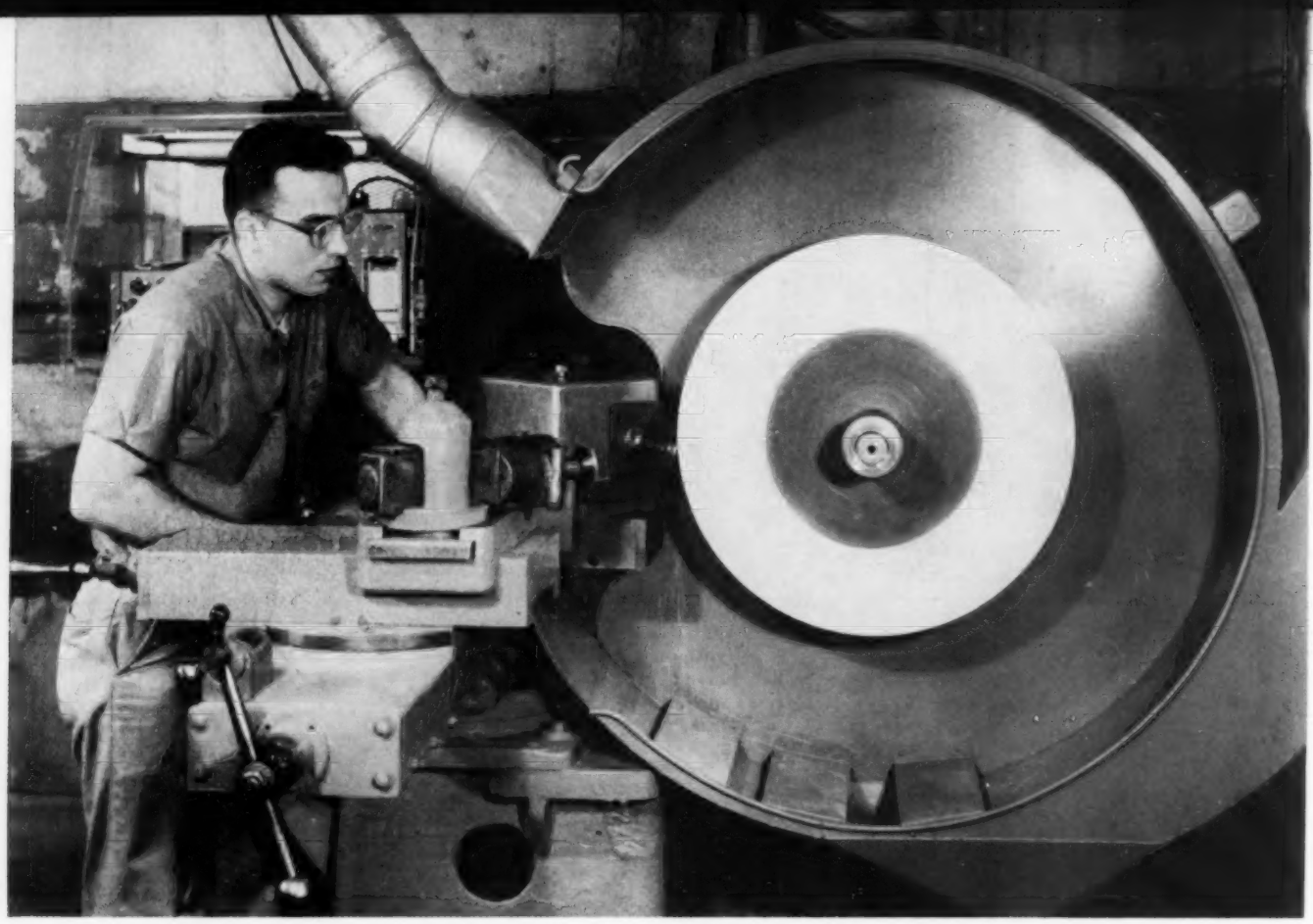


Fig. 1. Test equipment resembles standard bell edger. Wheel speed is 2700 rpm.

Development promises more uniform wheel grading

Results of a research project in wheel hardness presage more accurate, quick, and economical grading of abrasive wheels on a production scale; may produce basis for predicting wheel performance under varying conditions or on different machines.

By L. V. COLWELL
R. O. LANE
K. N. SODERLUND

● A grinding wheel in operation can be thought of as a single compression spring in series with several other compression springs. Other "springs" are the spindle, work holder, workpiece, etc. Under load all will deflect. If any one of the springs is replaced by a softer or more flexible spring, all others in the series will act harder or stiffer relative to the over-all stiffness of the series.

Thus, in any production shop, a grinding wheel may be moved from one machine to another and judged to act harder or softer, though the actual hardness of the wheel remains unchanged. The change in functional hardness is nevertheless real, since it results from a change in over-all system rigidity, of which the grade of the grinding wheel is only one element.

Every user of grinding wheels is familiar with the difficulties of measuring their hardness. The problem has been investigated for more than 40 years. While several new techniques have been developed, the repeated starting of new investigations is testimony that the problem has not been solved sufficiently to meet the need.

A recently-announced crush cutting process has shown in the laboratory that it is accurate, quick, and economical for grading abrasive wheels on a production scale. Orderly and susceptible to precise measurement, it promises a universally applicable hardness scale involving dimensionless numbers, from which corresponding industrial standards can be developed. The measured forces correlate logically with factors which are important in actual grinding, and reflect the elastic properties of the abrasive as well as those of the entire machine set-up.

Further study can reasonably be expected to produce a basis for predicting chatter, information concerning the effect of machine rigidity on grinding behavior, and a technique for predicting the performance of a given grinding wheel on different machines or under different conditions.

Test Equipment

The laboratory set-up used on this problem is shown in Figure 1. Wheels 12 x 1 x 5 were mounted on an adapter fastened to the driving plate of an engine lathe with a 12″ swing.

A cutter or crushing wheel consisting of a 90° included angle conical cup with 0.100″ thick wall, often described as a bell tool, was mounted on a free-running spindle. The center line of the spindle intersects the center line of the lathe spindle at an angle of 45°.

The cutter spindle was mounted on a two-component lathe dynamometer which in turn was fastened to the cross-slide by a suitable adapter. The dynamometer measured forces both vertically and horizontally.

Crushing or cutting of the abrasive wheel is accomplished by setting the cross-slide for the desired depth and then feeding the cutter across the face of the wheel in either direction. The surface velocities of the two wheels are the same, and true rolling takes place.

This process is used by some grinding wheel manufacturers to true up wheels after they are fired or cured.

Test Results

A speciment chart of test results is shown in Figure 2. Plotted on logarithmic coordinates, it reflects the effects of variation in wheel grade or hardness.

For grade, as for structure and grain size in other charts not shown, the lines are nearly parallel, reflecting an orderly change in crushing force as both the feed and depth are changed. The full significance and possible use of such information depends on further study. It was observed that the mechanisms which control behavior in the crushing zone are quite complex, and that they take place very rapidly.

Applications

One obvious application of this process is for inspection and quality control of grinding wheels. It has already been in use for this purpose for several months.

Figure 3 is a reproduction of the original test record of a 30 x 8¾ x 12 vitrified wheel produced before this method of inspection was put into operation. The customer claimed that the wheel was defective. The test record substantiates the complaint. It is hard on the sides and soft in the middle in a ratio of about two to one. The right-hand side does show a variation in hardness from 20 to 25% around the circumference of the wheel, which caused an out-of-round condition in the part being ground.

Fig. 2 (above): chart of test results.

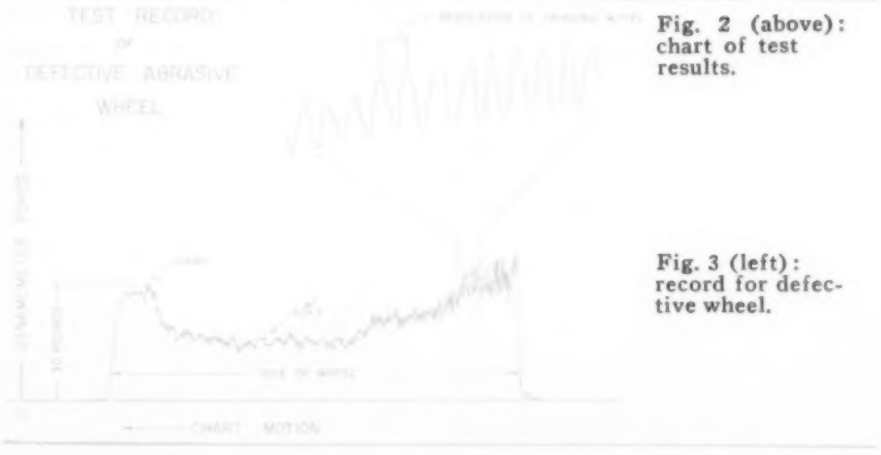


Fig. 3 (left): record for defective wheel.

The procedure is fast and economical. A single pass across this wheel required only 23 seconds. New cutter wheels are used from an original diameter of 3″ down to 2¾″ and then transferred to the main cutter spindle, where they were used up. This caused a cutter cost of about one cent per day for inspection.

More important than low cutter cost is the uniformity of cutter wear; the contact surface is always the same shape and size. This is very important for the maintenance of consistency.

The feasibility of a two pass procedure for establishing industrial standards for grinding wheels was briefly explored. The procedure proved to be both dependable and repeatable, but will require further investigation.

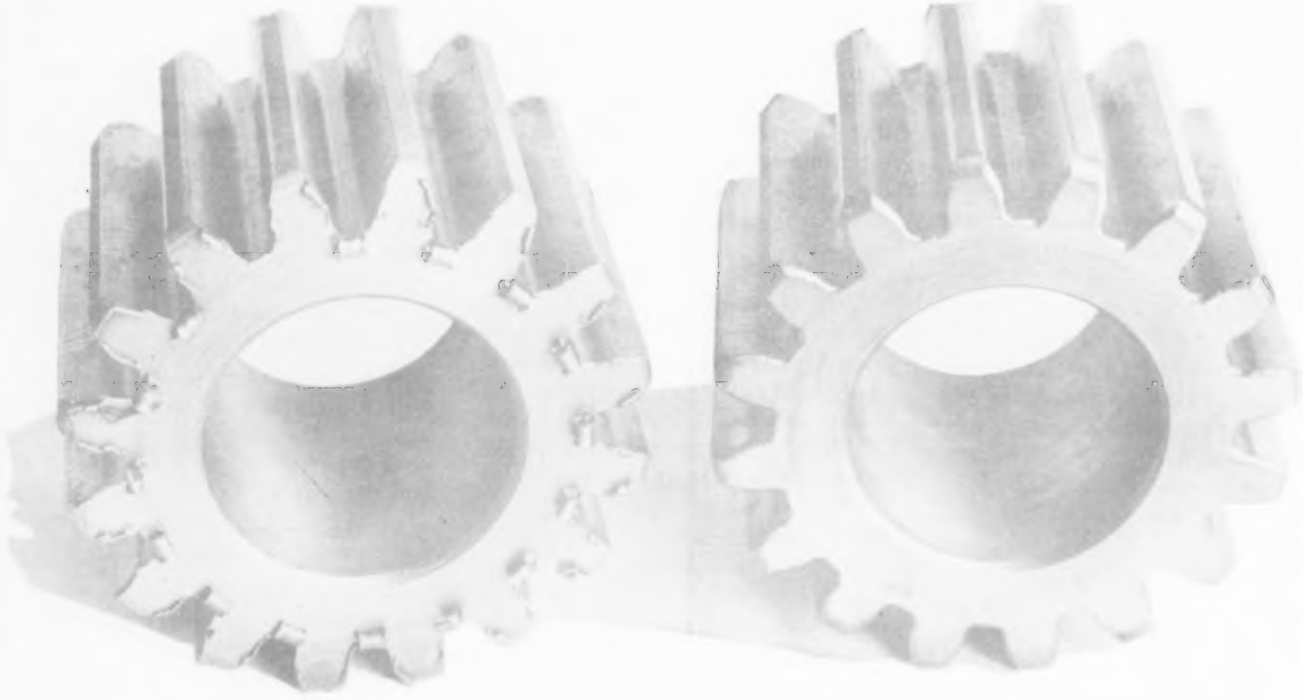
In this approach the cutter was adjusted for a particular depth and feed rate, and then fed at a constant rate across the face of the grinding wheel. The resulting force was measured. Then it was passed across the face of the wheel again, but without changing the depth setting. Any residual elastic deflection from the first pass would cause further crushing on the second pass.

A series of 12 x 1 x 5 wheels were tested with the two-pass procedure under the same set of cutting conditions. The ratio of the second pass force divided by the first (and multiplied by 1000 to avoid decimal points) produced a range from a low of 111 to a high of 575 for vitrified wheels.

This basis for assigning hardness numbers provides a maximum value of 1000. Both hardened steel and soft rubber, it might be noted, would yield the same result— a hardness rating of 1000. This is as it should be, because neither would break down or crush under load if it were the bonding material, and both would act exceedingly hard in actual grinding.

There are some practical problems associated with using the force ratio as a hardness number. These occur primarily at low hardness where the force on the second pass approaches zero, and small errors in force measurements give rise to large variations in the hardness number. However, this can be overcome by proper selection of test conditions. • • •

Acknowledgment: Based on Paper No. 61—Prod-8, presented at the Production Engineering Conference of The American Society of Mechanical Engineers, Toronto, Ontario, Canada, May 10-12, 1961, and published by permission of the Society.



Brushing gear burrs and radii

By EDWARD P. FISHER • Manager, Finishing Machine Sales • The Osborn Manufacturing Co.

Increasing closeness of manufacturing puts greater stress on finishing of gears and similar type drive assembly components. Properly applied power driven brushes for high production machines are an accepted method for the removal of burrs and blending edges.

● A variety of requirements demand uniform finishes for gears and component parts used in modern automotive transmissions and drive assemblies.

The use of close tolerances is required because of the compact design inherent in these parts. Edge blends and radii on the junctures of mating parts make uniform finishes even more mandatory.

Modern methods of free machining plus the use of easily heat treatable steels produce more pronounced burrs. High production requirements created by the use of automated equipment in primary operations often cause even heavier burr conditions, especially when tools are used beyond their most efficient working points.

Trouble free performance of transmissions and drive assemblies is a vital factor in light of foreign competition, which is becoming an increasingly important consideration in quality part production.

It is now more important than ever to employ finishing equipment and tools which most effectively produce blends and radii at the junctures of intersecting surfaces.

Power driven brushes, designed for machines capable of removing burrs and blending edges, offer a fast, efficient means of finishing parts made in high volume and which require uniformly blended edges.

Brushes and equipment for this operation must be carefully chosen for maximum efficiency and economic performance.

Basically, the brush is the controlling factor, and the equipment must be designed around it. The proper wire brush, when used with good finishing equipment, will produce uniformly finished parts throughout the life of the brush.

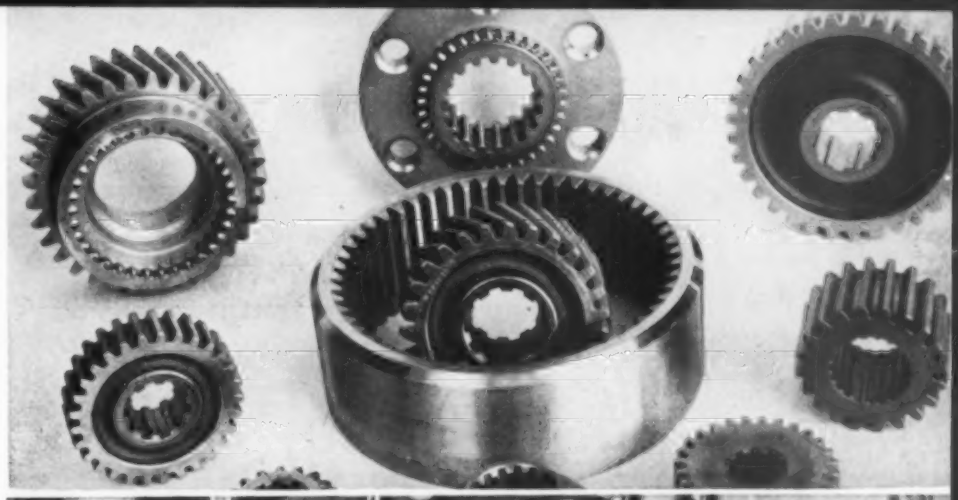
Gears shown before and after brush finishing. (left)

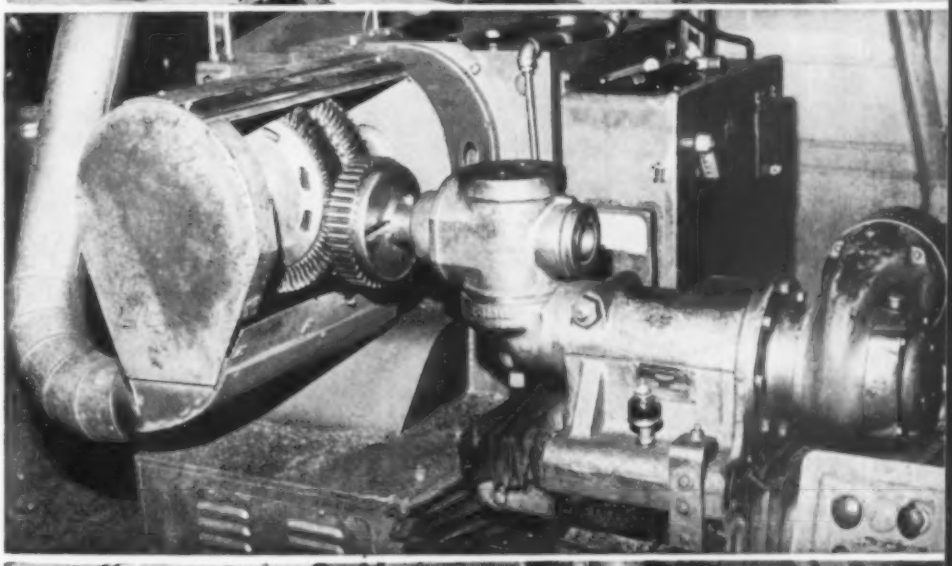
Variety of gears brushed in the green following hobbing and broaching.

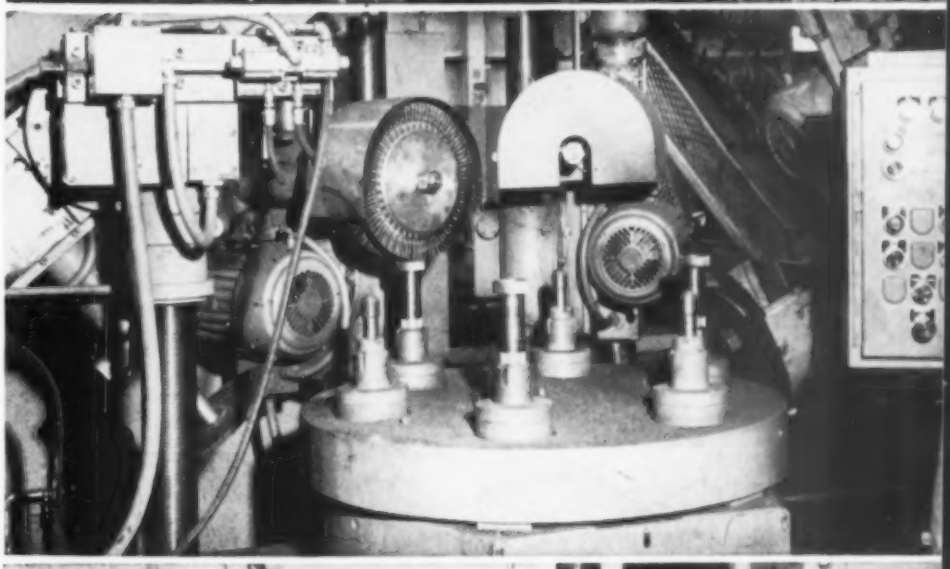
Osborn No. 4 metal finishing machine using Tufmatic brushes for removing burrs from gear teeth.

Internal gear teeth as well as splines on the OD are finished on this rotary index machine.

Automotive transmission gears being finished on a rotary index machine prior to shaving.







To use wire filled brushes most effectively and to produce parts of high quality, the normal operational sequence for finishing gears is:

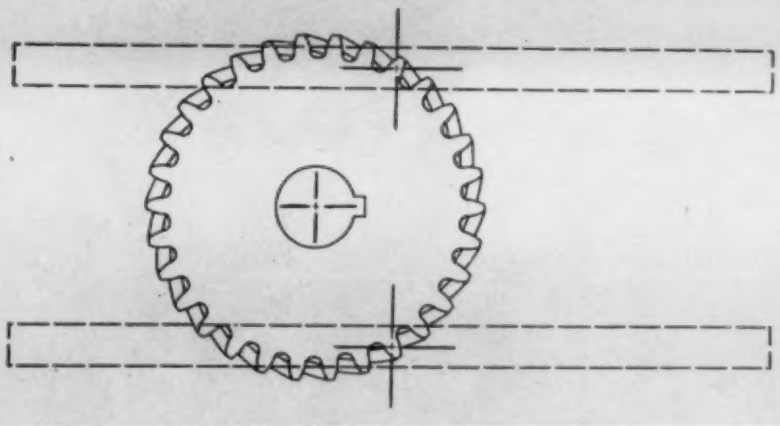
1. Gears are hobbed and internal or external splines broached;
2. After broaching or hobbing, the parts are finished with wire filled power driven brushes;
3. Shaving of the gear teeth or grinding of the face sides of the broached areas;
4. Heat treating.

Brushing the parts after the hobbing or broaching operation permits the brushes to remove the burrs and at the same time produce a generous radius. On helical gears, an adequate radius is required on the acute angle side because shaving of the gear will produce an extremely sharp edge.

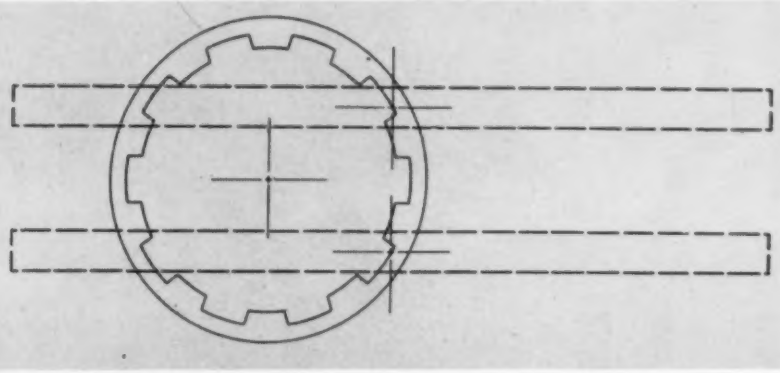
Shaving of the parts following brushing can follow without any fear of fragmented slivers developing at the intersection of the surface or blistering of the compacted metal at the tooth profile during heat treating. The radii produced during brushing is large enough to provide a blended edge after shaving.

Wire filled brushes are selective to an edge. They will remove metal without changing the dimensions of the machined surfaces. • • •

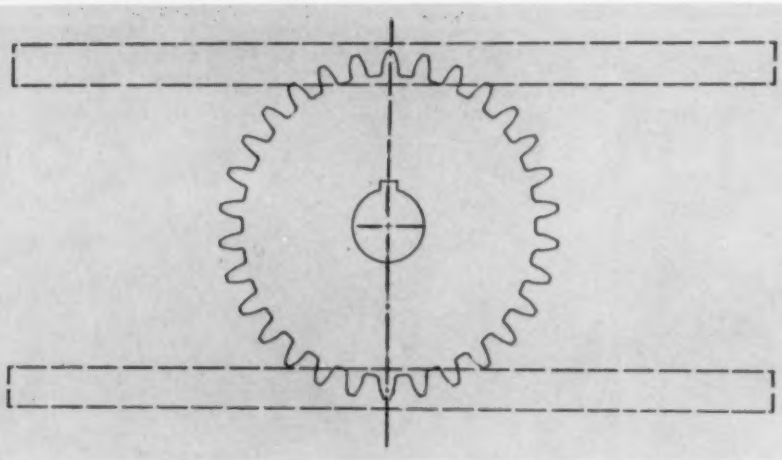
BRUSHING GEAR BURRS AND RADII *continued*



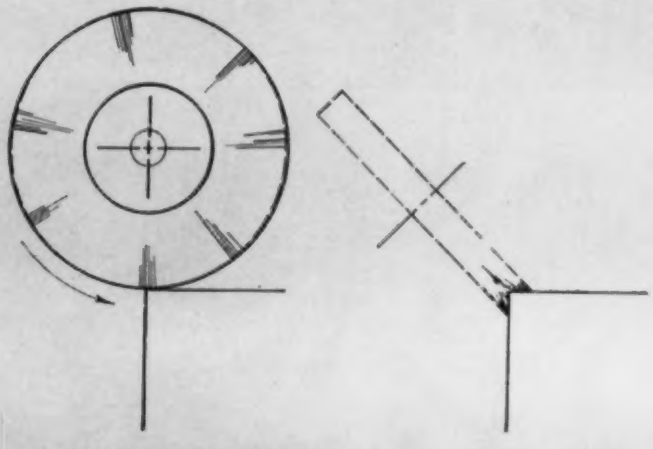
When helical gears are brushed it is sometimes necessary to favor the acute side of the gear tool to develop a generous radius before shaving. This is accomplished by locating the brushes as shown.



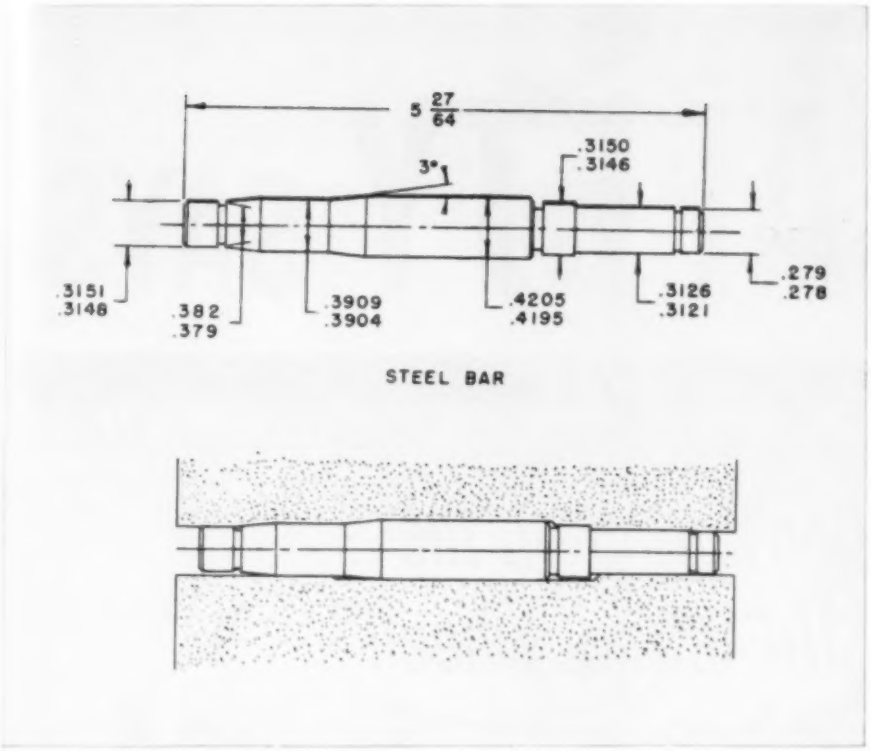
The setup for brushing spline bores differs from brushing gears in that the brushes are located off center. A type of brush that does not require reversing to maintain its cutting points should be used.



When brushing gears, two brushes are spaced to contact the tooth profile on the center line of the gear. This permits using brush reversal to maintain the wire brushing points at their maximum cutting efficiency.



Proper relationship of the part and brush contact is extremely important. The brushes should be set to brush across the edge. (left)



Schematics show tolerances held on the various diameters and the forms maintained in the wheels.

7 diameters in 7 seconds

Electric motor rotor shafts, requiring the grinding of seven diameters, are ground at 50% higher rate on centerless which replaced two machines.

View of the Van Norman 2-C Diversimatic centerless grinder with hopper feed for automatic loading and unloading.

Special to GRINDING and FINISHING

● A prominent electric motor manufacturer was finishing rotor shafts in two operations. Tolerances for the seven diameters could not be held in one operation. Loading and unloading on his equipment was manual.

Problem

Increase production of 300 parts per hour while holding tolerance and finish on cold rolled steel shafts of Rockwell 30.

Solution

Centerless grinding with automatic loading and unloading. All diameters on the shaft requiring ground surfaces are ground in one operation by a Van Norman 2-C. Loading fixture holds about 300 parts which are loaded between the wheels and ejected to the back of the machine. Form for the seven diameters is dressed into the wheel from a master profile cam.

Results

Centerless grinder production is 480 pieces per hour. Run-out is held to less than .00015" and finish is held to 10 to 12 rms. • • •

SAM SAFETY SAYS:

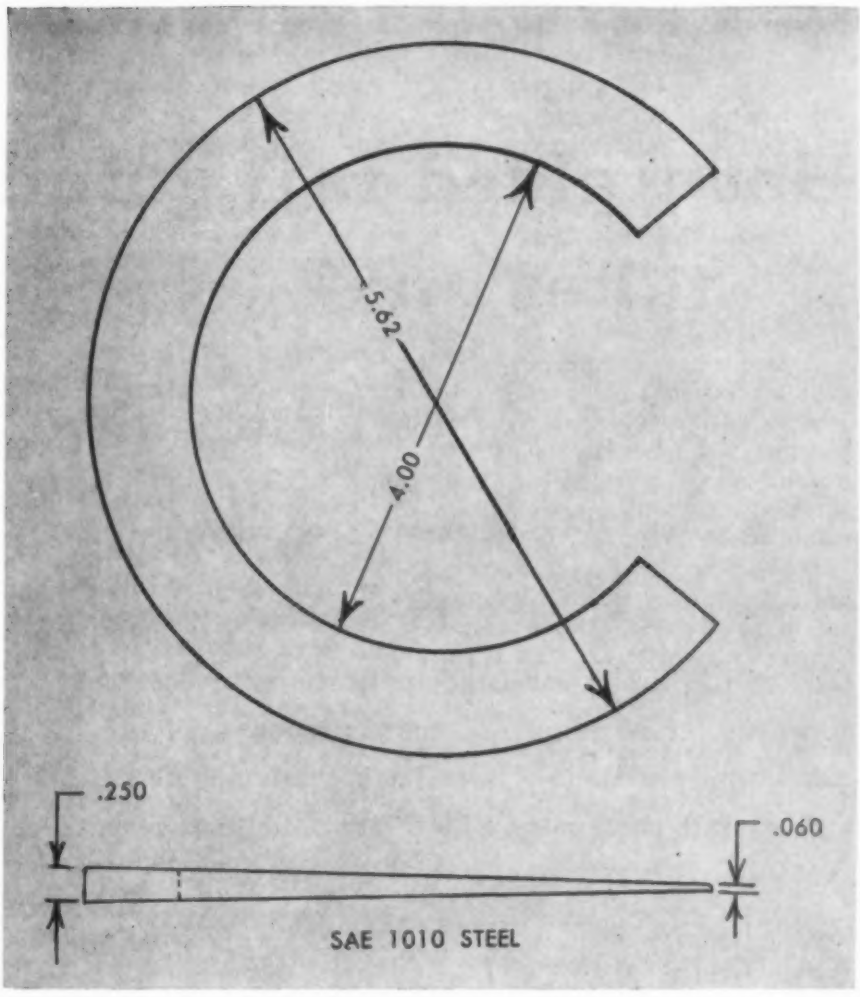
No. 24 of a series • GRINDING and FINISHING • 1961

Single copies: Circle No. 130 Reader Service Card.

Tilt grinder head to finish taper

By ALDO OLIVERO, President
Grinding Products Co.

Shimming the head of a surface grinder to extend its tilting range was the key to fast, low-cost finishing of a tapered "C" washer.



● Tapering this "C" washer was not a case of doing it better by grinding, but of doing it at all, by any method, at a production rate.

A leading automobile manufacturer had closed a plant for ten days, or until they could secure an adequate supply of the tapered "C" washers which they needed to alleviate trouble in the front spring assembly of their cars.

They had sent blueprints and requests to shops in three states, to see if anyone could make enough washers quickly enough for their needs. No system for immediate production was available. Most of the shops considered the job impossible.

Problem

Manufacture, at a production rate, "C" washers or shims as illustrated, 5.62″ OD, 4.00″ ID, tapered one side from .250″ to .060″. Material: SAE 1010 steel. Neither stock removal nor surface finish was a difficulty.

Alternatives

Some form of surface grinding appeared to be indicated. The size of the piece, the amount of taper, and the thickness of the thin side probably ruled out other forms of machining.

Evaluation

The angle of the taper was greater than the range of any surface grinder we had, but otherwise this method was adequate.

Solution

The first approach was to tilt the head of a Blanchard No. 18 surface grinder to well beyond its normal range. This was accomplished by placing heavy tapered shims at the anchoring positions.

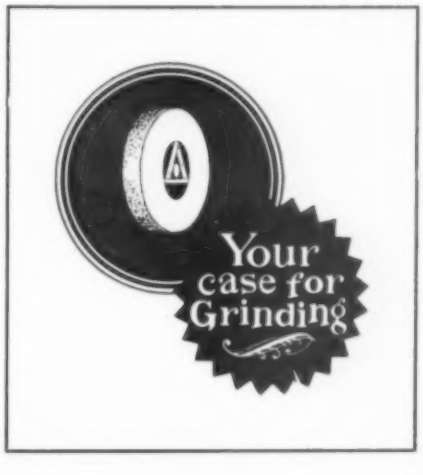
For grinding, the washers were located, open ends out, around the periphery of the chuck.

With the assistance of a grinding wheel engineer we came up with a wheel specification to provide high production and quality combined with long life—a 24 combination grit aluminum oxide vitrified wheel in a medium-soft (H) grade and dense (2) structure.

Results

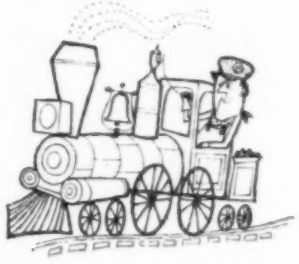
Ten hours after we were first approached we ground our first shims. We were in production for two weeks while the other shops were still only talking about the job. Up to the present (May) we have ground 60,000 of these washers. No other method, we feel, could possibly have done the job on such short notice and at such low cost.

• • •

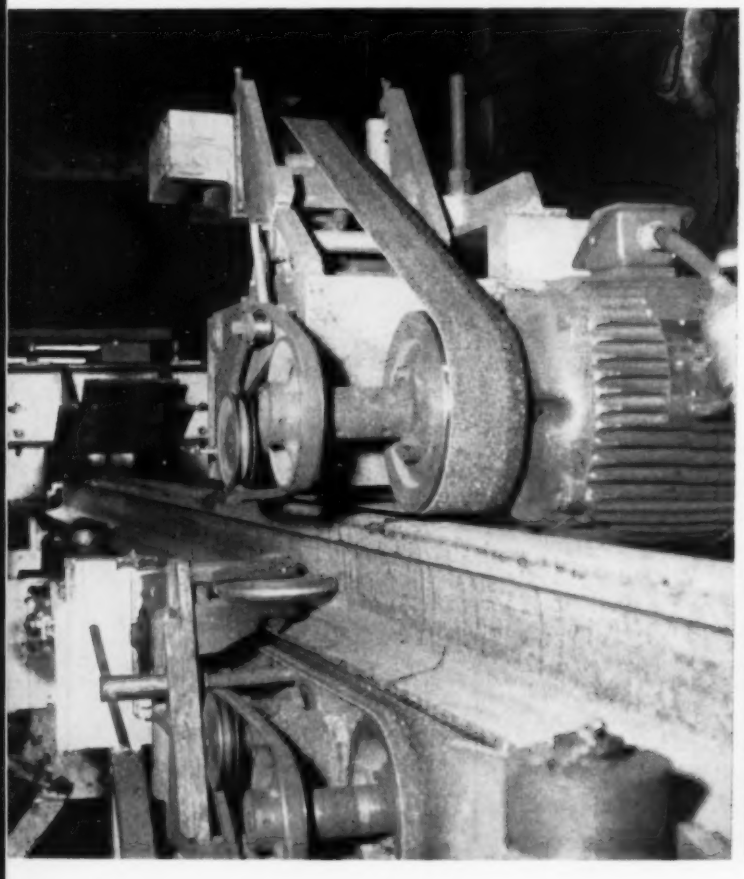


Hot welded rail grinding takes out CLICKETY-CLACK

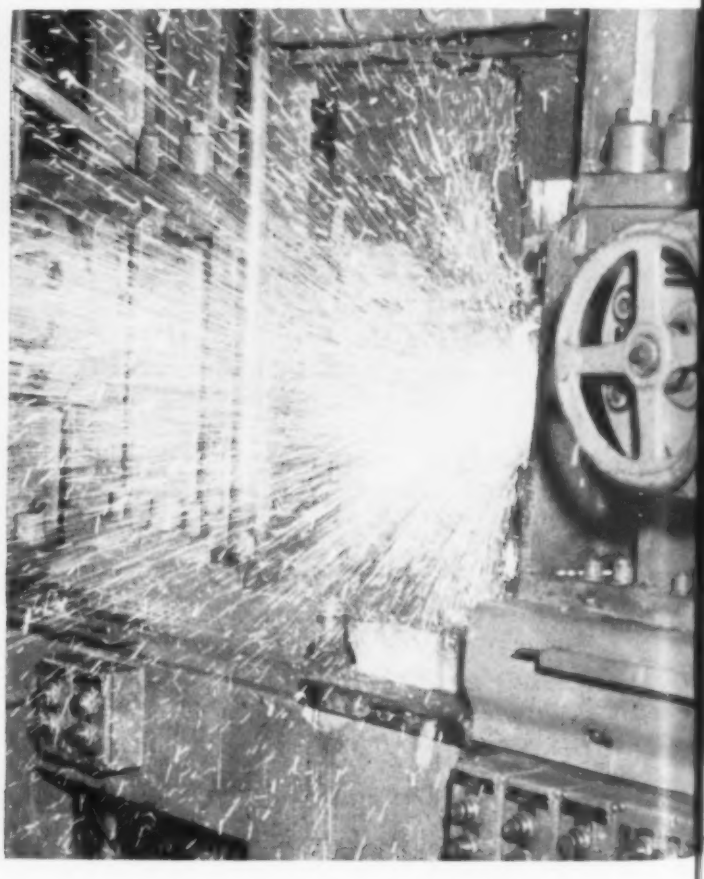
One of the first successful applications of coated abrasives for grinding hot metal produces smooth quarter-mile sections of rail. Besides reducing noise, welded rail cuts costs $1,000 per mile per year.



Tops and bottoms of rail ends are scoured clean by small belt grinder before rail goes to welding.



Sparks fly in welding process. Cover (up for photo) is normally pulled down to contain sparks.



● Coated abrasives grinding hot metal in continuous rail welding operations are helping take the clickety-clack out of railroad track.

It is one of the first successful production applications of coated abrasives for hot metal grinding. In continuous rail welding, the ends of two rails are heated to the plastic state and fused under high pressure. Then the weld is blended.

In a typical operation, 33 or 34 standard (39 foot) rails are joined to form a quarter mile long or longer rail. Removing the sound of wheels pounding across rail joints is only the audible result. Railroads are saving more than $1,000 in maintenance of way costs per mile per year by installing continuous rail.

In one process, that of the National Cylinder Gas Division (NCG) of Chemetron Corp., 39 foot rails are joined at the rate of one weld every 5 to 8 minutes with equipment housed in a special railroad car that can be operated on a rail siding. To maintain that welding rate, excess molten metal (upset) squeezed from each welded joint must be removed quickly. After all but 1/32″ of the upset is sheared off, grinding is done while the metal is in the red heat stage. The weld leaves the welder at 1,800° F., and is removed quickly to the grinding station where the remaining upset is ground away at a temperature near 650° F.

On one NCG rail welding unit, used on the Great Northern Railway near Fargo, N.D., this year, a machine with two grinding heads does that job. The grinder, built by the Fenlind Engineering Co., automatically lowers one grinding head and moves it across the top of the rail, removing sheared upset from the sides and top of the rail head. Simultaneously, another head strips the remaining upset metal from the edges and bottom of the rail. The bottom head is moved automatically into three operating positions.

The belts, cutting at a removal rate of three pounds of metal per minute, finish each weld in seconds. The upset covering each weld is about .031″ thick and .5″ wide.

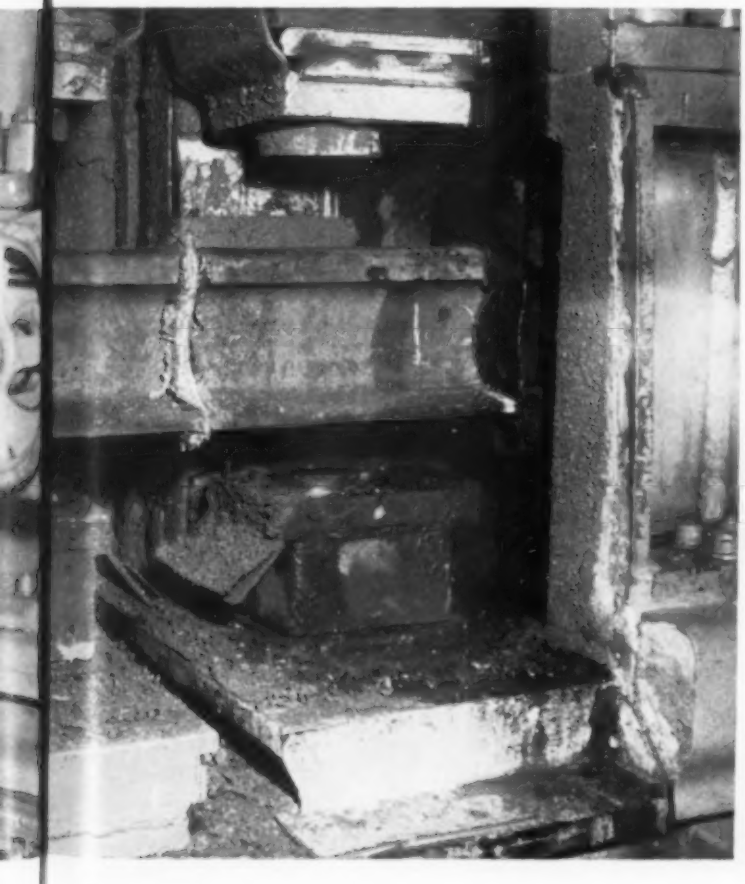
The contact wheels are run at 1950 rpm and 4550 sfpm.

A 5″ by 132″ grit 24 Three-M-ite Resinbond cloth belt is on the top head. The same type and grade of belt in a 9″ width is on the other. Both are oscillated to make full use of the width. Both contact wheels are drive wheels.

Older grinders built into six other NCG units use six belts for grinding the hot sheared welds. The belts are positioned in two groups. In the first group, one abrasive belt grinds the bottom of the rail and two others grind the sides of the rail head simultaneously. In the second group, one belt grinds the full contour of the top of the head while two others grind the edges of the base. In these units, backing belts are required and grinding is done in progressive steps as the welded rail passes continuously through the grinder.

continued

Excess material ("upset") is squeezed from hairline by steady pressure and a sudden blow up to 50 tons.



Coated abrasive belts have ground the upset from the sides of the weld, leaving a smooth joint.

GRIND LONG RAILS

continued

The new two-belt grinder removes the upset while the rail is stopped at the grinding station. Contact wheels are positioned and the grinding cycle begun by an operator with pushbutton controls at the grinding station, but the grinding cycle is automatic. There is no production delay because another weld is being prepared while the previous weld is being ground.

Another automatic belt grinder, also built by Fenlind, scours mill scale and rust from top and bottom of each rail end before welding. That assures good contact between electrodes and rails in the electronic welding process. That grinder, activated by a rail end passing between the heads, cleans while the rail is moving toward the welder.

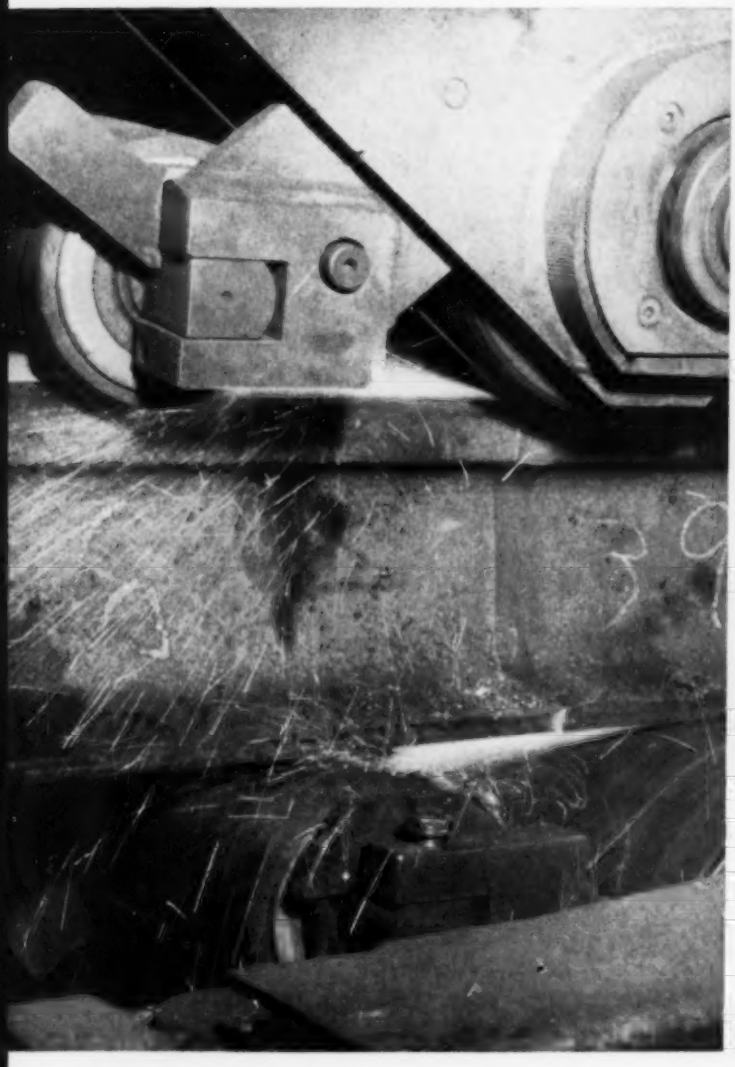
Coated abrasives for hot metal grinding are not limited to continuous welded rail projects, naturally, but welded rail in itself offers vast potential. In the seven years from 1954 through 1960, only 4,156 miles of welded track (8,312 miles of welded rail) were laid by US railroads. That is only a fraction of the total miles. And many railroad officials are enthusiastic about installing more continuous welded rail.

For example, the GN figures it saved $228,810 in maintenance of way costs last year with only 263 miles of welded track in its system. The figures were based on a study of a 56-mile stretch of track in the GN system in Montana. GN officials stressed that the figures were conservative.

Several years ago, the American Railway Engineering Association surveyed 20 railroads using continuous welded rail. The annual average savings was $1,043 per mile for welded rail, compared with upkeep costs for angle barred (conventional) rail. Many engineers said they felt that average would rise sharply in future years as savings were re-evaluated.

NCG's Mobile Rail Welding Unit (manufactured and modified in the USA under license from H. A. Schlatter, AG, Switzerland) is extensively automated. One man, the welder, controls the rail handling equipment and the welding unit with pushbutton controls. Another operates the grinder and assists in the maintenance of both units. The railroad provides a locomotive crane, four men and a foreman to load the rails on the feeder table, inspect the welds and guide the welded rails onto a string of 30 flatcars.

Coated abrasive belts grind upset from top and bottom of welded rail in a single operation.



Another view. Bottom belt is finished. Top belt, which grinds entire rail head, is still operating.

Equipment consists of a 60 ft., 70 ton steel boxcar containing the welder, grinder and a rail pusher manufactured by Link-Belt Co., plus auxiliary equipment. The rail storage and transfer table, with powered rollers to feed rail to the welder, are mounted on a flatcar.

An optional 50 ft., 50 ton car containing diesel powered generating equipment is used if commercial power is not available. In a recent project for GN at Fargo, N.D., a commercial power supply was used.

A flatcar to house the "Mag shack" where the Magnaflux inspections of the weld are made, is behind the welding car.

In making a weld, the trailing end of one rail is clamped to the left hand platen in the welder. The rail to be welded comes from the transfer table at the right through a shear box (which surrounds and conforms to the shape of the rail) and is clamped in a movable platen on the right side.

Hydraulic cylinders (pushbutton operated) provide horizontal and vertical movement to allow the welder to align the two rail ends.

The first welding phase is the preheat cycle. The right hand platen moves backward and forward. During contact, current flows between the rail ends, building up heat. Six to 10 impulses of welding current (about 90,000 amperes, 10.6 cycles) are applied automatically until welding temperature is reached.

That heat is measured automatically by the conductivity of the metal.

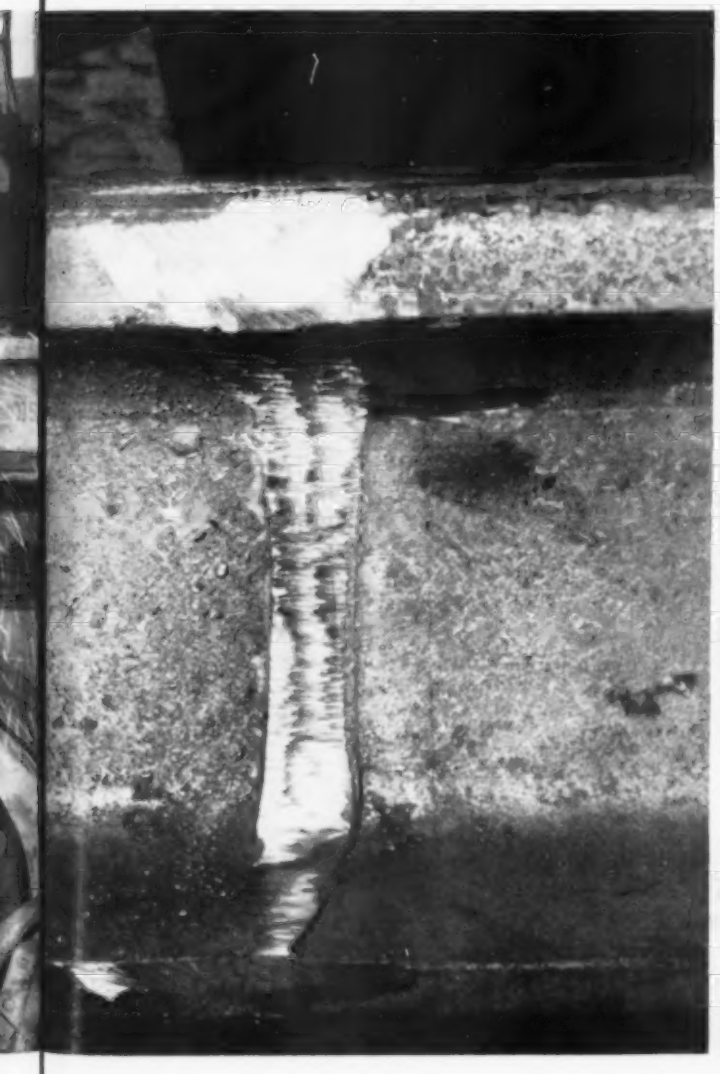
When that stage is reached, flashing off begins. The right platen and rail move forward steadily. About ¼" of metal on both rail ends is burned off. A narrow band of plastic metal separates the two rails. After the platen moves that controlled distance, the forging blow (a patented system) is struck as an air cylinder, through a system of levers, is released from control of a hydraulic cylinder.

In the flashing off stage, a steady controlled pressure compresses the rail ends. An instantaneous blow of up to 50 tons, depending on rail size, follows after the flashing off period is completed. That squeezes out foreign matter, gases and surplus metal from the joint. Upset material is left on the rail.

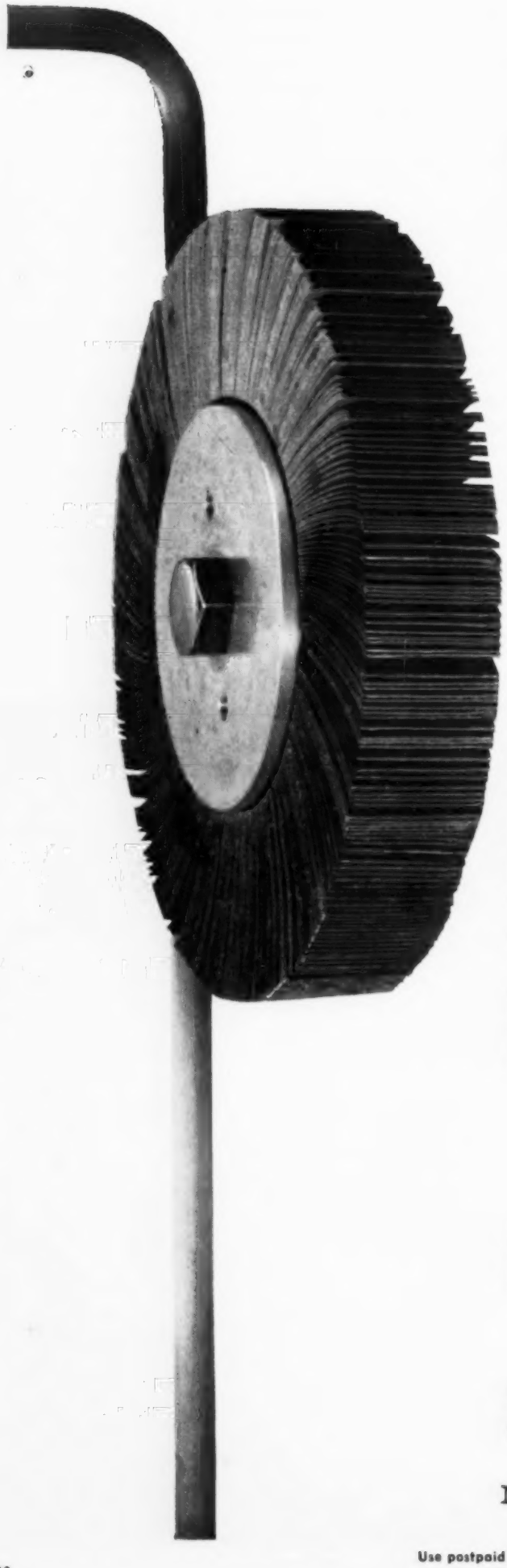
While red hot, the upset is trimmed to a fraction of an inch by the shear block.

Apart from the advantage of a thin-line weld, the speed of the forging blow prevents the diffusion of heat and eliminates the need for annealing of the weld section. Annealing (also called normalizing) is necessary with other available forms of rail welding, either gas or electric. • • •

Completed weld with upset ground from head and base of rail. The weld was ground while red hot.



Magnaflux test of each weld. Faulty welds are sent back, cut, and rewelded. Pushbutton signals are used.



3MAGINATION
in GRINDING
and FINISHING

"PG" WHEEL REDUCES FINISHING TIME 50%

Stainless steel sink frames, manufactured by R. D. Werner Co., Inc., Greenville, Pa. are satin finished in half the time using the "PG" Wheel. Recommended by a 3M representative to replace a previous method, this unique 3M abrasive tool has practically eliminated rejects while producing a more consistent final finish.

COST CHECK 5-4-5 **Why not let 3M's new COST CHECK 5-4-5 Program help you to effectively investigate ways to lower costs and increase production. Discover . . .**

- If your grinding can be done more economically
- If your finishing is as efficient as possible
- If your polishing can be done faster and better

Send today for a free COST CHECK 5-4-5 Review Form without obligation. Put 3M's years of abrasive know-how at your disposal. Write: 3M Company, 900 Bush Avenue, St. Paul 6, Minn. Dept. AAH-81.

3M COATED ABRASIVES

"3M" AND "PG" ARE REGISTERED TRADEMARKS OF 3M CO., ST. PAUL 6, MINN.

MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

Use postpaid card. Circle No. 230

Informative reading in abrasive operations for management, engineering, production.

Flat Finishers

Use postpaid card. Circle No. 1

Flat finishers for grinding, polishing, deburring flat work are presented in 12-page catalog. Describes a variety of flat finishers and their accessories. Also includes a section devoted to the manufacturer's methods of laboratory testing of customers' work. Hammond Machinery Builders, Inc., Kalamazoo, Michigan.

Plant Equipment

Use postpaid card. Circle No. 2

Catalog No. 33, 64 pages long, contains a complete line of plant maintenance, safety, and production equipment. Presents dimensional drawings, how-to-use-it photos and complete prices. Martindale Electric Company, 1375 Hird Ave., Cleveland 7, Ohio.

Direct Reading Micrometer

Use postpaid card. Circle No. 3

Speedmike, a direct reading micrometer, is presented in a 4-page folder. Contains large cutaway drawing which depicts design and construction of the digitally read instrument. J. T. Slocomb Co., 68 Matson Hill Road, South Glastonbury, Conn.

Index Center

Use postpaid card. Circle No. 4

Brochure shows how Moore index center is used as a precision tool for inspection work on centers; jig boring; milling and jig grinding on centers; and form grinding where revolving the part on centers or in a spindle is necessary. Includes specifications and performance data. Moore Special Tool Company, Inc., 800 Union Avenue, Bridgeport, Conn.

(See No. 4)

Metal Finishing Guide

Use postpaid card. Circle No. 5

Four-page guide contains condensed information on materials and compounds for such finishing operations as buffing, burring, polishing, and satin finishing. Includes a section on additives and specialties for bright plating processes for gold, silver, copper, nickel, cadmium, brass, and zinc plating. Lea Manufacturing Co., 16 Cherry Avenue, Waterbury 20, Conn.

Oversize Granite Surface Plates

Use postpaid card. Circle No. 6

Special line of oversize granite surface plates for precision measurement of large parts and assemblies is described and illustrated in 4-page bulletin. Describes uses, applications, and construction. Herman Stone Company, 1860 N. Gettysburg Ave., Dayton 27, Ohio.

Cutting-Off Grinding Wheels

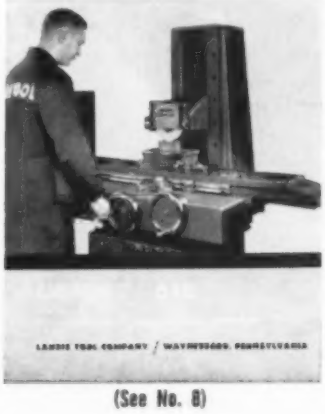
Use postpaid card. Circle No. 7

Folder No. 222-16 describes and illustrates line of cutting-off wheels specially formulated for longer life and elimination of burn. Contains specification data of wheels for cutting off wide variety of metals. Peninsular Grinding Wheel Company, 729 Meldrum Ave., Detroit 7, Michigan.

Surface Grinder

Use postpaid card. Circle No. 8

Eight-page catalog, No. 618H-61, illustrates and describes the Landis 618 hydraulic precision surface grinder. Describes various applications and uses, operation, and standard equipment. Landis Tool Co., Waynesboro, Pa.



(See No. 8)

Barrel Finishing

Use postpaid card. Circle No. 9

Recommended compounds and media are described in a 4-page folder presenting Chicago Wheel's Model A-1-59 barrel finisher. Provides specifications, advantages, and description of the machine's application and operation. Chicago Wheel and Mfg. Co., 1101 W. Monroe St., Chicago 7, Ill.

Micro-Form Grinder

Use postpaid card. Circle No. 10

The Sheffield Model 121-C microform grinder is presented in a four-page bulletin. Discusses highlights of machine's operation, attachment, and application. The Sheffield Corporation, Division of Bendix Aviation, Dayton 1, Ohio.

Air Tools

Use postpaid card. Circle No. 11

New Dotco air tools are detailed in Bulletin 103. Lists right angle and vertical sanders and grinder for contour finishing of dies, mould castings, forgings, castings, and for deburring. Dotco, Inc., Hicksville, Ohio.

Precision Finishing Media

Use postpaid card. Circle No. 12

Catalog-bulletin discusses problems in selection of right abrasive media and compounds for use in vibratory and barrel finishing. Illustrates wide variety of media-types for mechanical finishing operations and includes illustrations of bonded preforms and hardened steel shapes. Also discusses various special problems. Roto-Finish Co., 3700 Milham Rd., Kalamazoo, Mich.

(See No. 12)

OLSON FILTRATION ENGINEERS *Cincinnati 12, Ohio*

OL-17-G

Send complete information on the new Olson "package" coolant filter.

*Name*_____

*Firm Name*_____

*Address*_____

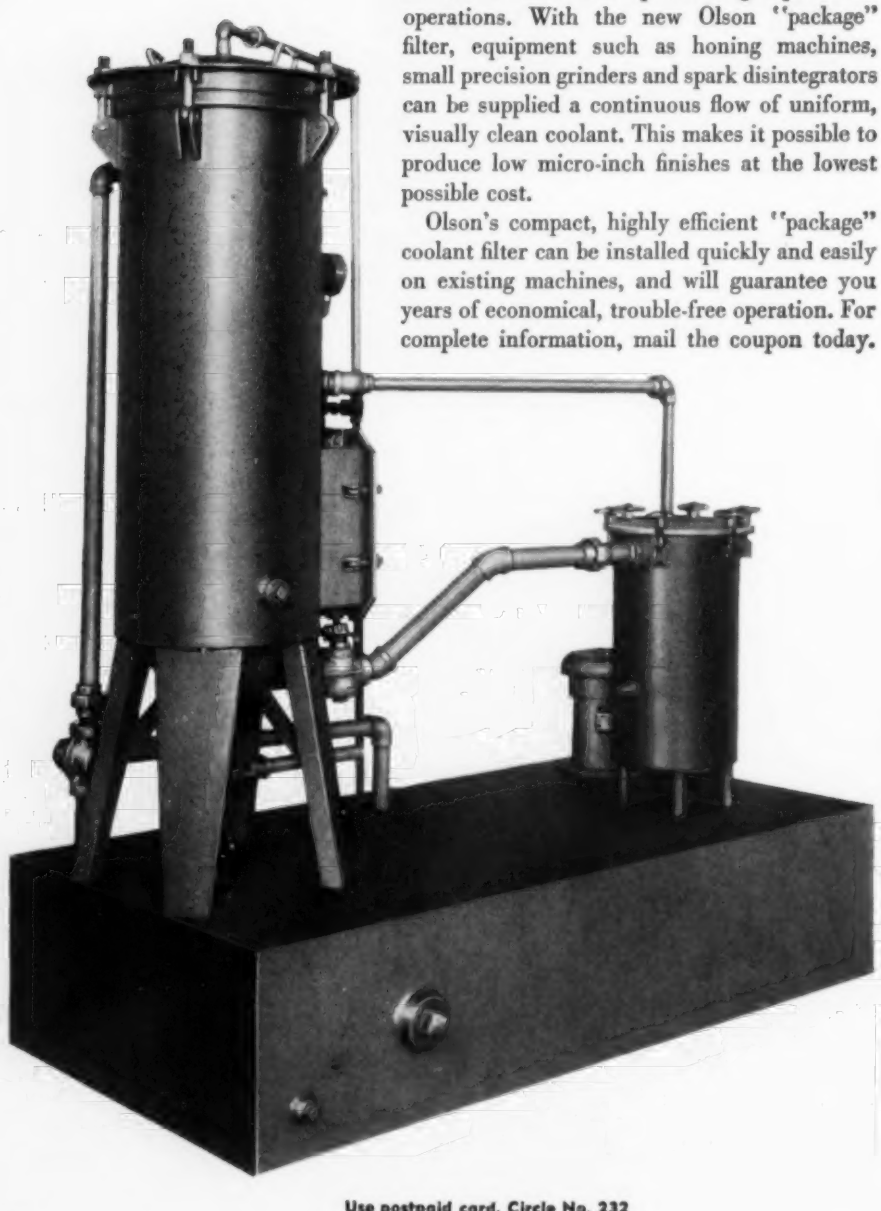
*City*_____ *Zone*____ *State*_____

Only from Olson . . .

"PACKAGE" COOLANT FILTERS FOR INDIVIDUAL MACHINES

Now you can lower your cost-per-part even on individual machines performing specialized operations. With the new Olson "package" filter, equipment such as honing machines, small precision grinders and spark disintegrators can be supplied a continuous flow of uniform, visually clean coolant. This makes it possible to produce low micro-inch finishes at the lowest possible cost.

Olson's compact, highly efficient "package" coolant filter can be installed quickly and easily on existing machines, and will guarantee you years of economical, trouble-free operation. For complete information, mail the coupon today.



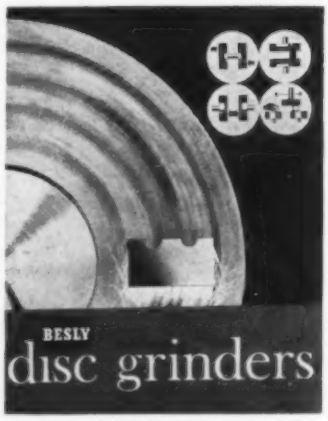
Use postpaid card. Circle No. 232

LITERATURE continued

Disc Grinders

Use postpaid card. Circle No. 13

Nineteen disc grinders are presented in a 22-page illustrated brochure. Cut-a-way photos show the operation of the Besly sealed spindle quill construction. Each section accompanied by brief commentary on the machines' applications, operations, and uses. Includes descriptions of special grinders for special problems. Besly-Welles Corp., South Beloit, Illinois.



Grinding Booklets

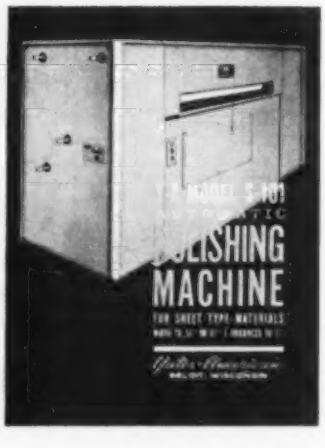
Use postpaid card. Circle No. 14

"The Art and Science of Grinding" is a 48-page booklet. Topics discussed in the booklet include: grade; grain; making grinding wheels; operating speeds; various types of wheels; shapes of wheel faces; and how wheel bevel is obtained. Sterling Grinding Wheel Co., P.O. Box 801, Tiffin, Ohio.

Automatic Polishing Machine

Use postpaid card. Circle No. 15

Four-page bulletin presents the new Model S-101 automatic polishing machine. Highlights special features of the unit, presents specifications, and discusses the uses, applications, and operation of the unit. Also includes brief descriptions of various accessories available. Yates American Machine Company, Beloit, Wis.



Diamond Wheels

Use postpaid card. Circle No. 16

Catalog 461-R presents Wickman Manufacturing Company's line of diamond wheels. Each section is illustrated and accompanied by sizes available and their prices. Includes a section explaining wheel marking system and another devoted to the care and maintenance of diamond wheels. 16 pages. Wickman Manufacturing Company, 10325 Capital Ave., Oak Park 37, Mich.

Lap Grinding

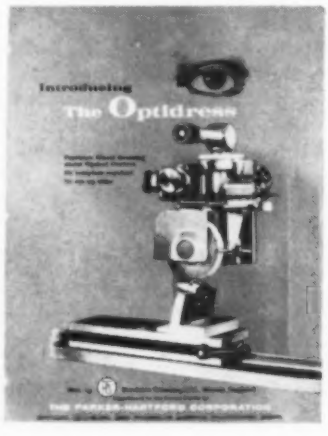
Use postpaid card. Circle No. 17

Six models of precision flat lap grinders are presented in an 8-page catalog from the Speedlap Corporation. Includes illustrations of the machines accompanied by brief mentions of their highlights. Describes a typical lapping sequence which illustrates simplicity of speedlapping. Also presents a chart showing Speedlap capacities. Speedlap Corporation, 3636 W. Oakton St., Skokie, Ill.

Optical Wheel Dressing Attachment

Use postpaid card. Circle No. 18

Six-page brochure describes the Optidress, an attachment for dressing grinding wheels optically. Shows in detail how the attachment uses a 10x microscope to assure blend between radii and angles in forming the wheel. Optical Division, Parker-Hartford Corp., 650 Franklin Ave., Hartford, Conn.



CULPRIT?

Here it is, the mighty 42" AA1 Chuck — armed with razor-sharp FM segments — guilty of slashing costs, beating competition, and shattering production records in major plants throughout the country. Go get it! Big rewards!

MODUS OPERANDI: Gets self invited into factory. Proceeds to remove stock at tremendous rate (but real cool), throwing off chips and grinding residue as it goes. Slashes grinding time and abrasive costs up to 50%.

DESCRIPTION: *Size:* 42" dia. (can be found with smaller and larger accomplices. *Build: really* built! *Distinguishing Characteristics:* echelon segment arrangement and unique segment design (among many reasons for its reputation). A quick-change artist. *Scars:* none. *Tattoo:* fm, center each segment.

AREA OF OPERATIONS: Progressive, cost-conscious plants everywhere.

HANGOUT: See below

For a complete stoolpigeon's report, write today!

AA1 Chucks may be used with practically any surface or face grinder.

THE FM

LITERATURE ON REQUEST.

FULLER MERRIAM COMPANY 72 Water St. West Haven, Conn. Telephone WEst 3-2501

A GUIDE TO GRINDING WHEEL SELECTION is available on request.

Use postpaid card. Circle No. 233

"What have you done about this DUST?"

In our plant trouble is spelled D-U-S-T. And our plastics production V.P. wanted to know what I had done to get rid of it. He was mad, and frankly, I didn't blame him. Dust was costing us a lot of money each year—in machine wear, misalignment and down time—to say nothing about absenteeism and poor morale among the workers. How could the plant help but be dusty—with grinders, lathes, milling and molding machines running 16 hours a day.

But I explained that I had checked on several dust control systems. The problem was that in 6 months we planned to expand and re-model the shop. It seemed like throwing good money after bad to invest in a control system now. But the V.P. wanted action. He told me about a Torit engineer who had called on him claiming he had a dust control system that offered complete *flexibility.* Then he gave me his card and suggested I call him immediately.

Believe me, I called that Torit man, but fast. He explained to me the flexibility his system offered—how with just minor changes it could be adapted to the new plant layout. I bought one of his Torit Model 24 Cyclone machines for less than $1,000. It services 2 molding machines, a double-end grinder, 2 lathes and a milling machine. And it really performs—has practically eliminated the dust in our shop. We're finishing our expansion and I have ordered another Torit Dust Collector to service our additional machines. You'd hardly recognize our shop now. It's clean. Production is up—morale is up—absenteeism is lower than ever.

Cyclone Model 24

Torit can solve your dust problems. For complete facts on dust . . . and how to control it . . . write

TORIT manufacturing company

1133 Rankin St., St. Paul 16, Minn., Dept. 532

Use postpaid card. Circle No. 234

LITERATURE continued

7" Grinder

Use postpaid card. Circle No. 19

Bulletin illustrates and describes newly improved Walker-Turner 7" grinder. Includes specifications, catalog listings, and information on new features. Dept. 1018, Walker-Turner Division, Rockwell Mfg. Co., 400 North Lexington Avenue, Pittsburgh 8, Pennsylvania.

Motorized Spindles

Use postpaid card. Circle No. 20

Pope Spindle Bulletin S-23 contains complete specifications on new line of high precision motorized spindles. These heavy duty spindles are available from one to 20 hp and from 900 to 3600 rpm. Pope Machinery Corp., 261 River St., Haverhill, Massachusetts.

Steel Storage Equipment

Use postpaid card. Circle No. 21

Sixteen-page booklet, "12 Losses Penco Planning Can Control," Illustrates various advantages of steel storage equipment. Contains 63 illustrations which show the kinds of equipment available to storage system planners. Penco Division, Alan Wood Steel Company, 200 Brower Ave., Oaks, Pa.

Grinding Wheel Shapes and Sizes Specifications

American Standard provides specifications for basic shapes and sizes of grinding wheels, classified according to their intended use. Describes grinding wheels and uses and also specifies various shapes employed for industrial manufacturing. Provides tables for grinding wheel use. Does not include data on specialized abrasive wheels. Title: "American Standard Specifications for Standard Shapes and Sizes of Grinding Wheels, B74.2-1960." Price: $1.50. American Standards Association, Dept. PR 233, 10 E. 40th St., New York 16, N.Y.

PATTEN HEADS PITTSBURGH

Jay Patten, Crucible Steel Co. of America, was elected president of the Pittsburgh chapter for 1961-1962, in a meeting held May 25. He was vice-president of the group last year.

Other officers chosen at the meeting are **Joseph DeBlander,** Universal-Cyclops Steel Corp., vice-president; **Allen Paine,** Simonds Abrasive Co., treasurer; **Clayton W. Waite,** Carborundum, recording secretary; and **Robert W. Legro,** Minnesota Mining & Mfg. Co., corresponding secretary.

Directors for the year are **Everett E. Cox,** Crucible Steel; **John A. Keefe,** Kennametal, Inc.; **Robert D. Joyce, Jr.,** Joyce Abrasive Sales Co., secretary in 1960-61; **Keith Bishop,** Cortland Grinding Wheels Corporation; **Eugene Daniels,** Universal-Cyclops, last year's president; and **James G. Bair,** national chairman and the original president of the chapter.

CHICAGO PLAYS GOLF, ELECTS OFFICERS

The end-of-the-season meeting of the Chicago chapter was a combination election of officers and golf day, held at Cog Hill Country Club, Lemont, Ill., on Saturday, June 10. Approximately 60 members and guests were at the session.

Robert E. Etherton, Cortland Grinding Wheels Corporation, was elected president, moving up from last year's position as first vice president. **George E. Miller,** Continental Drill Corp., succeeds him as first vice president, and **Joseph J. Carr,** treasurer, takes over as second vice president, following Miller. **Henry A. Hoppe** was re-elected for his third year as secretary.

Earl Hart, Western Electric Hawthorne Plant, is the new treasurer.

New members of the Board of Governors are **Theodor W. Bachman, Jr.,** Wheel Trueing Tool Company; **John Nelson,** Norton Co.; and **James Rathje,** Continental Can Company. **M. M. Patterson,** editor of GRINDING and FINISHING, continues, and **Robert S. Hanke,** Shafer Bearing Division, last year's president, serves another year on the board.

John Kafka, National Malleable Steel Castings, Melrose Park, was the winner of the trophy for low gross at golf. **Edward Caswell,** Vascoloy-Ramet, Waukegan, and **Frank Tarolla,** Supreme Products Corp., Chicago, tied for low net.

American Society For Abrasives

CONNECTICUT CHAPTER #1

For your information and notation, the following dates have been set up for our meetings starting in September: You will note that we will continue to meet on Monday evenings, and for the the most part, on the fourth Monday of the month.

September 25	February 26
October 23	March 26
November 27	April 23
January 22	May 21

A December meeting has not been scheduled at this point as it is being given further consideration.

Some of the program subjects we are attempting to line up include the following:

Grinding vs. Milling	Cost Savings in Grinding
Coated Abrasives	Grinding Exotic Materials
Grinding Wheel Safety	Grinding Coolants

Latest Techniques in Grinding

Under consideration is a joint meeting with the Society of Carbide Engineers at which the program would cover the latest information on man-made diamonds. A plant tour is anticipated for one of our meetings, and in May we will hold our Annual Sports Night.

We hope that these meetings will be of interest to everyone. Talk them up among your friends and prospective members and be sure to get them interested in joining our Society so that they can get the full benefits of these meetings and have a voice in making our Chapter bigger and better.

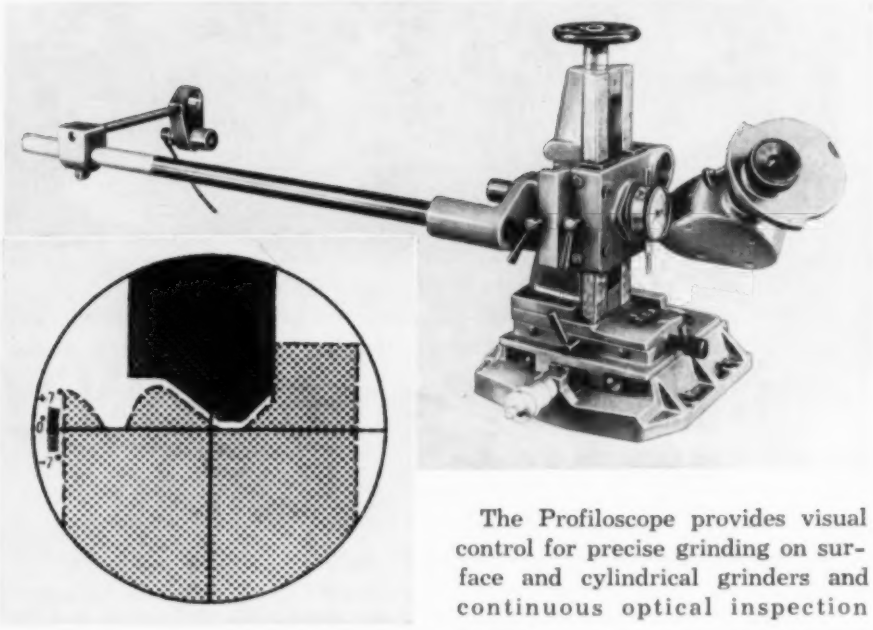
Editor's Note: The above material has been reprinted verbatim from the final membership letter of the Connecticut chapter for the 1960-61 season. It has been used in line with our policy of printing on this page items of general interest to the Society and to prospective members.

DETROIT TALKS BEARINGS

"Bearings and How They Affect Grinding" was the subject discussed by **T. F. Daly, Jr.,** and **W. C. Thompson** of Detroit Ball Bearing Company of Michigan at the Detroit chapter's June meeting, held June 22 at the Warren Valley Golf Club.

Thompson is general sales manager of the company and Daly is sales manager of its industrial division.

OPTICAL ATTACHMENT PROVIDES VISUAL CONTROL



The Profiloscope provides visual control for precise grinding on surface and cylindrical grinders and continuous optical inspection through all stages of form grinding.

It is an independent optical unit that can be attached to standard grinders in use.

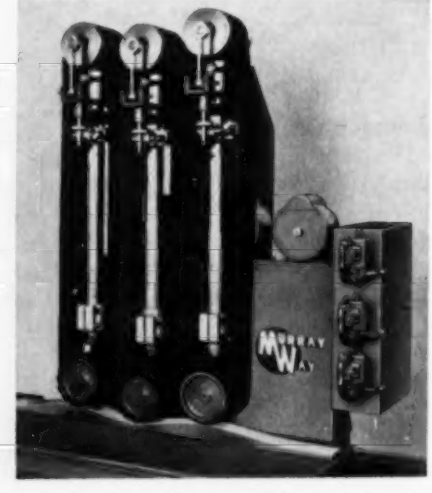
The Profiloscope facilitates control of irregular and intricate forms. Width, depth, and coordinate checks are facilitated to readings of .0002" on special form tools.

Six standard reticles are contained in a rotating turret head on the instrument. They are marked with male and female radii, angles, and horizontal and vertical lines. Special full form reticles can also be supplied.

Optical Division, The Parker-Hartford Corp., 650 Franklin Ave., Hartford, Connecticut.

Use postpaid card. Circle No. 65

GRINDS VARIED SHAPES IN ONE PASS



Flat, formed, or contoured parts, both long and short, can be ground wet or dry, from roughing to finishing in one pass by Murray-Way's new multiple-float abrasive belt heads.

Each head floats independently of the others, permitting simultaneous rough and finish grinding of a work piece as it passes beneath the compact unit. One motor will drive up to three heads at once.

The rise and fall of each head may be controlled by the contour of the part itself (where polishing is the principle function), or by a cam shaped to the production part (where shaping or closer tolerance grinding is required).

Continuous travel or reciprocating conveyors may be utilized for traversing the parts beneath the heads.

Belt tracing and oscillation are controlled automatically to prevent belt run-offs. Oscillation of idler rolls is supported by an angular thrust bearing for friction-free pivoting.

Abrasive belt tension is maintained by a built-in air cylinder. Hand-operated valves allow release for quick belt changes.

The standard machine is equipped with 5" wide by 90" long belts, but the tubular support for the idler roll may be lengthened or shortened to accept belts of other lengths. Air controls are mounted in a closed panel.

Murray-Way Corporation, P.O. Box 180, Birmingham, Michigan.

Use postpaid card. Circle No. 66

PEDESTAL MOUNTED FLEXIBLE SHAFT UNIT

A pedestal mounted flexible shaft machine is provided with large casters for easy movement around the shop.

The machine, designated the "Lightning," operates at 1750 rpm and is available with either a 1/3 or 1/2 hp motor. It is furnished with a 5 or 6 ft. long flexible tool shaft and a quick-disconnect handpiece.

The unit also features a bench-height pedestal which makes it convenient for bench work, grinding, brushing, or buffing operations.

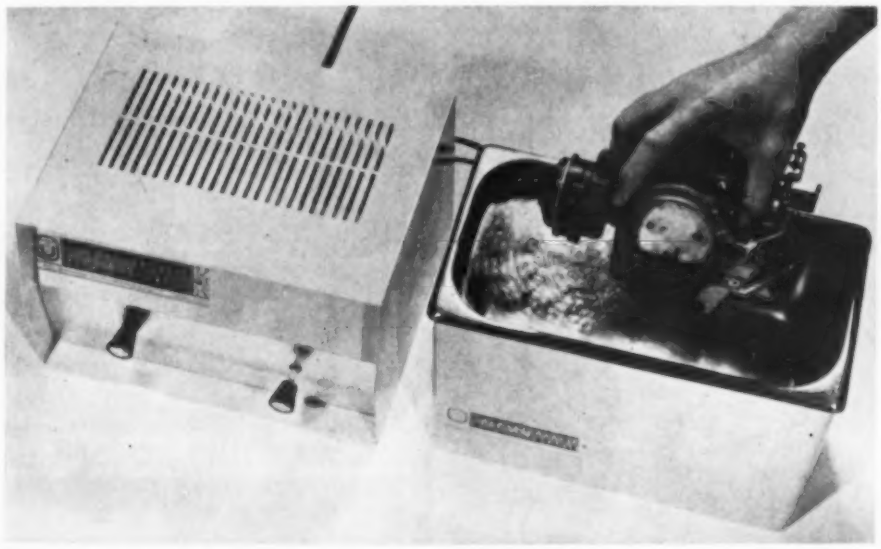
Stow Mfg. Co., 310 Shear Street, Binghamton, New York.

Use postpaid card. Circle No. 67

SUITED FOR SALVAGE OF GRINDING TOOLS

The Disontegrator System Eighty, a 1½-gallon capacity ultrasonic cleaner, is said to be ideally suited for salvaging grinding wheels, tools, burrs, etc. The System Eighty, guaranteed for five years, features a broad band frequency modulated circuit which eliminates the need for automatic tuning as found in higher priced equipment.

The 1½-gallon capacity cleaning tank has a working compartment measuring 12" long by 6" wide and 6" deep. A 9"-deep tank is also available.



In operation, the generator is plugged into any convenient source of 117 volt-50/60 cycle current and consumes no more current than a light bulb.

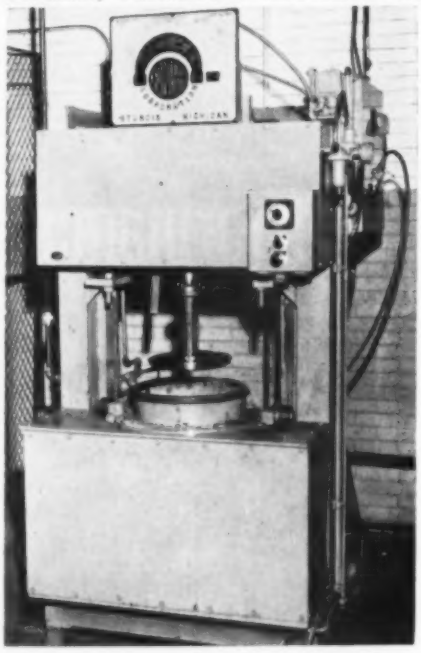
Cleaning begins as soon as the tank is filled with a suitable cleaning solution. When ultrasonic energy is propogated in a cleaning solution the fluid is exploded 90,000 times per second into millions of submicroscopic vacuum bubbles.

This bubble bombardment disintegrates injurious soils. Complete precision cleaning of all types of soils is achieved, not only on the surface, but in the smallest, hard-to-reach crevices in a matter of seconds. Intricate parts can be cleaned without disassembly.

Ultrasonic Industries, Ames Court, Engineers Hill, Plainview, L.I., New York.

Use postpaid card. Circle No. 68

BURRS, FINISHES I.D. AND O.D. SURFACES



The new oscillating, vibrating Mechamatic machine is designed to burr and finish the I.D. and O.D. of light and also heavy components with open ends.

The illustration shows a jet engine spacer, which has a multitude of holes around the periphery, to be burred inside and out without disturbing the dimension of the hole.

While the burring is being done, surface improvement is obtained as a free operation. This application can substantially reduce burring time.

Air-operated fixtures, which can be quickly changed, are used to hold the work pieces.

Mecha Finish Corp., Sturgis, Mich.

Use postpaid card. Circle No. 69

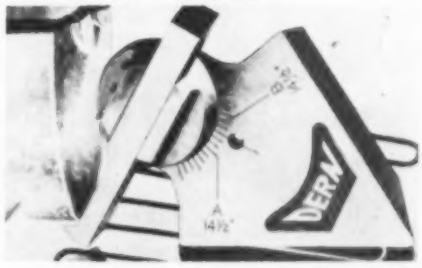
SINE TOOLS OF ALLOY STEEL

A new line of sine tools consists of a high quality sine bar and sine plate made from alloy steel and hardened for maximum wear and deep frozen for maximum stability. The rolls are matched to .00005" and the separations of the tools is controlled to 5" ± .00015".

Adam Tool Co., 50 E. 11th Street, New York 3, N.Y.

Use postpaid card. Circle No. 70

SIMPLIFIES GRINDING OF SECOND SIDES



The Dern universal lathe-tool holder does not require resetting of the holder to grind the second side of the tool. In operation, the turret—which can be rotated 360°—is set at the desired tool angle. The tool is then inserted and tightened.

After one side of the tool is ground, the holder is merely flipped for grinding of its other surface. All kinds of lathe tools—turning, chamfer, grooving, forming, internal, external, offset, right or left hand—can be ground on the unit.

Designed in triangular form with an included angle of 60°, each side

continued

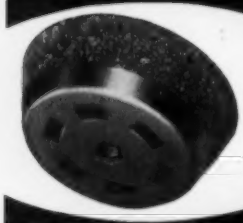
Quality

diamond wheels by

THE PAUL L. KUZMICK CO.
271-279 GROVE AVE.
VERONA, N. J.

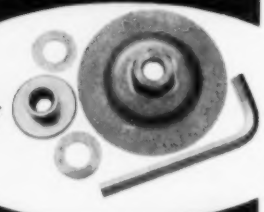
Use postpaid card. Circle No. 235

SAFETY BACKS



STRAIGHT AND FLARED CUPS

SAFETY FIRST



LOW COST ADAPTOR KIT

The new low cost Carroll Adaptor Kit made of cold forged steel offers outstanding features not found in other designs costing several times more. Strong — Wear Resistant — Rust Resistant — High Quality.

Also designers of:

• Carroll Safety Backs • Throw-A-Way Hubs • Track Grinding Wheel Safety Backs • Heavy Duty Disc Wheel Inserts

Write for further information

CARROLL
PRESSED METAL, INC.
133 DEWEY ST.
WORCESTER 10, MASS.

SPECIALISTS IN ALL TYPES OF GRINDING WHEEL METAL INSERTS

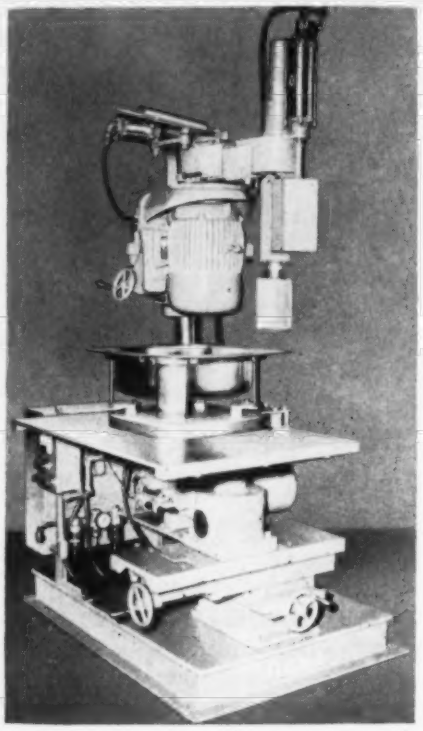
Use postpaid card. Circle No. 238

of the angle is compounded with a 5° clearance angle. Graduations on the tool holder are in 5° increments to 45° with special indications at fourteen one half degrees. The holder adapts to height gage use for accuracy as required.

Dern Tool Co., 6833 Hinds Avenue, North Hollywood, Calif.

Use postpaid card. Circle No. 71

FOR INNER CONTOURS OF STAINLESS SINK BOWLS



A new special semi-automatic sink grinding and polishing machine automatically finishes the inner side contours of stainless steel sink bowls. The machine consists of a retracting spindle type adjustable lathe and roller feed unit mounted on a common base. The abrasive polishing unit is mounted on the lathe spindle.

The shape of the gear chuck conforms to the inside contour of the sink bowl to maintain a close contact between the bowl sides and the abrasive wheel. A spring tension permits the wheel to flow at and maintain pressure during the polishing operation.

Manual adjustments for table horizontal movement, spindle vertical movement, and wheel tilt are provided.

Acme Mfg. Co., 1400 E. Nine Mile Road, Detroit 20, Mich.

Use postpaid card. Circle No. 72

Dependability

diamond wheels by

THE PAUL L. KUZMICK CO.
271-279 GROVE AVE.
VERONA, N. J.

Use postpaid card. Circle No. 236

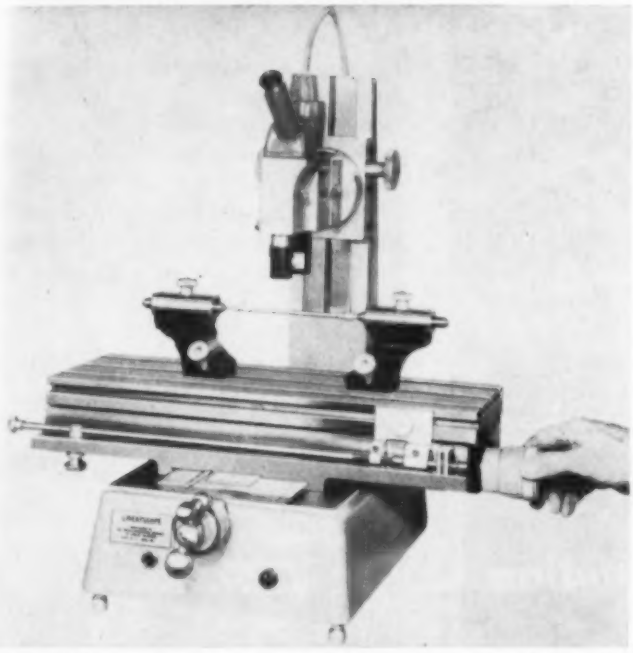
Performance

diamond wheels by

THE PAUL L. KUZMICK CO.
271-279 GROVE AVE.
VERONA, N. J.

Use postpaid card. Circle No. 237

RAPID MEASUREMENT INSTRUMENT FOR CLOSE TOLERANCE WORK



Precision measurements of dimensions can be made rapidly and accurately with Westwood Engineering Company's new Linerascope.

The instrument has a broad range of measurement uses including: scanning; scanning and measuring simultaneously; probing hidden recesses; checking squareness factors external or internal; measurement of linear dimensions between grooves; width and depth of grooves; diameters of beveled valve seats; sizes of ports; squareness of sides and ports; dimensions between ports at actual points of contact; and alignment of ports, etc.

Standing 22", the Linearscope is mounted on a rugged, internally-ribbed base 13" x 12" and weighs 150 lbs. The 6 x 20" tables are of Meehanite, stabilized to prevent warpage. The lower table rides on a V-way and the top table is carried on two long rows of precision ball bearings.

A 4" lateral movement of the table is controlled by a micrometer screw with direct readings to .0005". The 12" longitudinal movement of the table is controlled with gage blocks and a micrometer screw with direct readings to .0001". All T-slots are ground parallel with the table travel within .001" in 20".

The head can be turned through 360° and is calibrated 90° on each side of the center with a 5-minute vernier.

Westwood Engineering Company, 2234 Purdue Ave., Los Angeles 64, California.

Use postpaid card. Circle No. 73

MAGNETIC CHUCK ACCESSORY FOR USE WHERE MAGNETIC-CAUSED DISTORTION IS A PROBLEM

This surfacing plate is an accessory for magnetic chucks and is used where distortion caused by magnetism is a problem. It features a number of plungers which can be quickly set to support a work piece so that it may be machined in its natural, undistorted state. When the chuck is turned off, the piece remains as machined.

Homestrand Machine Tool Corp., 392 W. Putnam Avenue, Greenwich, Connecticut.

Use postpaid card. Circle No. 74

Now New Concept

in

GRINDING WHEELS

AGRABOND

a combination resilient rubber-bond wheel having the metal removal qualities of a rigid resinoid wheel and the finishing properties of a flexible polishing wheel.

Write for new literature today!

PEKAY ABRASIVES, INC.

271 Grove Ave., Verona, N. J.

Use postpaid card. Circle No. 240

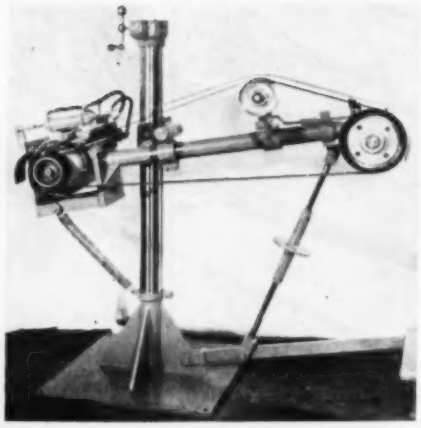
CLEANING COMPOUND

Belt-life, a compound developed for cleaning abrasive belts and wheels, contains an ingredient which extends the life of the belt or wheel by cleaning the abrasive surface, by preventing it from loading, and by maintaining its high cutting efficiency. It also lubricates the abrasive surface, enabling production of finer finishes.

Grav-i-Flo Corp., Sturgis, Mich.

Use postpaid card. Circle No. 75

LETS OPERATOR USE BOTH HANDS



Foot treadle operation of this special abrasive belt grinder for spot grinding applications permits the operator to use both hands to position the work piece.

The machine is mounted on a floor column and provides 12" of vertical motion using the foot treadle. A 7½ hp totally enclosed, fan cooled, ball bearing motor drives a 3" wide by 132" long belt.

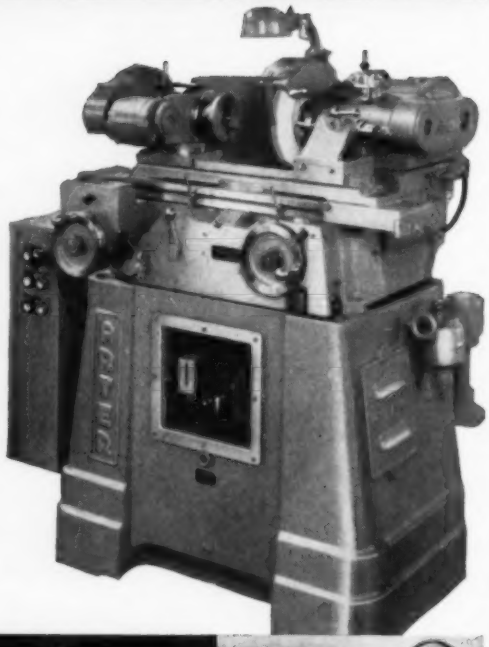
Grinding and Polishing Machinery Corp. 2530 Winthrop Ave., Indianapolis 5, Indiana.

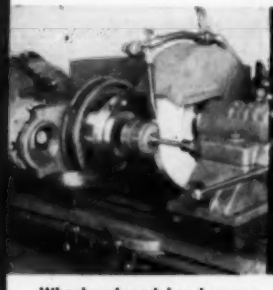
Use postpaid card. Circle No. 76

Best buy for toolroom or small-capacity production grinding

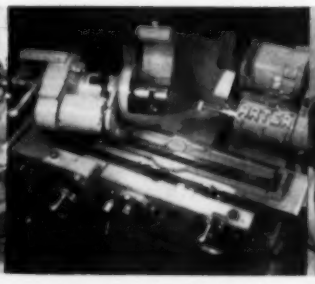
The Sundstrand-Arter Model 103 can be arranged for cylindrical or internal grinding. Wheel heads swivel 15 degrees either side of center — work head swivels 90 degrees. It's ideal for toolroom or production work where a small-capacity machine is needed, or for supplementing larger grinders when work piles up. Multiple-jaw chucks, faceplates, and other chucking accessories can be quickly attached to spindle nose.

Sundstrand-built to highest precision standards, this moderately priced grinder has a complete hydraulic movement of table and wheel head. Maximum capacities: external—3" OD, internal—3" ID.





Wheel and work head arranged to grind cylindrical work.



Internal grinding head with work head swiveled.

Work head swiveled 90 degrees to grind a gear shaper cutter.

For complete information, write for Bulletin 918.

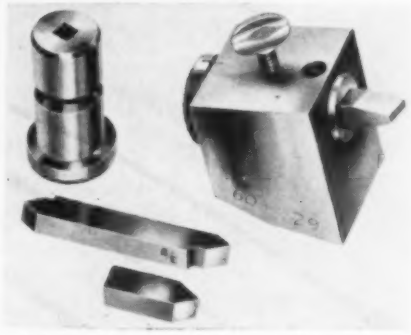
MARK OF RELY-ABILITY

SUNDSTRAND ARTER

SUNDSTRAND MACHINE TOOL
BELVIDERE, ILLINOIS
Division of SUNDSTRAND CORPORATION

Use postpaid card. Circle No. 242

THREAD TOOL GRINDING FIXTURE



Threading tools for cutting accurate, precision threads for internal and external V 60° and Acme 29° threads can be ground quickly with the use of the MRCO fixture on a surface grinder.

Model A block handles separate barrels for 3/16" 1/4", 5/16", and 3/8" square tool bits. Model B handles the barrels for 1/2" and 5/8" square bits.

Tool clearance is established by rotating the barrel to each side of the centerline on the block. Round bit holders and fixtures for grinding special shapes are available.

MRCO Tools Co., 2742 Chene St., Detroit 7, Michigan.

Use postpaid card. Circle No. 77

"This is the newest technique for removing stubborn corns, Miss Marchant."

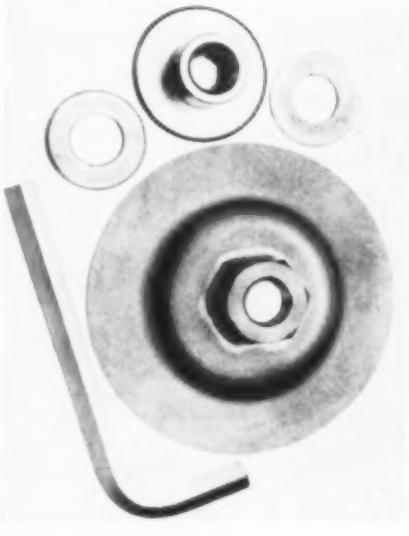
MINIATURE ELECTRONIC TACHOMETER

The Pioneer Photo Tachometer checks both constant speed and changing speed. No external power source and no electrical or mechanical connections with the product being measured are required. The unit is built around a light sensitive photoelectric cell which responds to minute illumination changes. All speeds from 0 to 12,000 rpm are calibrated accurately.

The Pioneer Electric & Research Corp., 743 Circle Ave., Forest Park, Illinois.

Use postpaid card. Circle No. 78

STEEL MOUNTING ADAPTER KIT



Outstanding features of the new Carroll adapter kits include cold forged steel which withstands wear and breakage better than fiber or die castings. Brazed nut to flange construction assures a better positive holding joint as shown by severe impact tests.

The kits are cadmium plated to provide rust-resistant surfaces. The contour design conforms to recommended standards established by the Grinding Wheel Institute.

Carroll Pressed Metal, Inc., 133 Dewey St., Worcester, Mass.

Use postpaid card. Circle No. 79

INDUSTRIAL LIQUID FILTER

The new Hilliard industrial liquid filter consists of a splashproof motor directly connected to a 35 gpm centrifugal pump. The tank contains an extended surface type throwaway filter element capable of removing particle sizes down to 5 microns. It is self-contained integral assembly which requires a minimum servicing time.

The Hilliard Corp., Elmira, N.Y.

Use postpaid card. Circle No. 80

PADS HAVE GREATER CLEANING ACTION

Abrasive particles impregnated into Scotch-brite cleaning and finishing pads provide greater cleaning and polishing action than similar materials.

The pads will remove surface carbon, handmarks, and stains from all metals. They will clean copper

MOORE ROTARY TABLES

For angular spacing jobs so precise you could never handle them before

NO. 2 ULTRA-PRECISE TABLE
Reads direct to 1 sec.

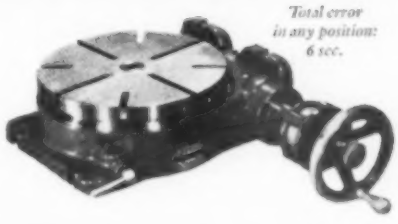
Total error in any position: 2 sec.

GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero to ± 1 sec.
All points in 18° increments, from zero to ± 1½ sec.
All points in 2° increments, from zero to ± 1¾ sec.
Worm accuracy—¼ sec.
Repetition of settings—½ sec.
Total error in any position—2 sec.
2 sec. = 0.00005" (½ tenth) on 10" dia.

Now...with this new No. 2 Moore Ultra-Precise 11-inch 2 sec. Rotary Table—you can provide the closest precision angular spacing needed today. It reads to 1 sec. and has an overall performance accuracy of ± 2 sec. throughout the entire 360°. It is being widely used in angular locations for guidance systems. A nondisengageable, thread-ground worm, combined with the accurately spaced teeth of its mating gear, makes this extreme precision possible. Loss of accuracy, due to repeated throwing in and out of the worm, is eliminated.

NO. 2 PRECISION TABLE
Reads direct to 5 sec.



Total error in any position: 6 sec.

GUARANTEED POSITIONING ACCURACY FOR SHOP USE

All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy—2 sec.
Repetition of settings—1 sec.
Total error in any position—6 sec.
6 sec. = .00015" (1½ tenths) on 10" dia.

This popular No. 2 Moore Precision 11-inch Rotary Table has an overall performance accuracy of ± 6 seconds throughout the entire 360°, and reads direct to 5 sec. It is being used successfully by leading companies on government-sponsored precision jobs never before accomplished. You can use this rotary table for countless precision spacing applications on jig borers and jig grinders.

• • •

Write today for descriptive literature about the Moore 2 sec. Ultra-Precise *and 6 sec.* Precision *Rotary Tables.*

Accuracy assured by interferometric inspection and calibration, the first time industry has used light-wave measuring methods for precise division of the circle.

These rotary tables are accurate in either horizontal or vertical position. Further applications are possible by using the table in conjunction with its companion unit, Model No. 2 Sine Plate.

MOORE SPECIAL TOOL COMPANY, INC.
725 Union Avenue, Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

Use postpaid card. Circle No. 244

FOUNDRIES NEED GRINDING EQUIPMENT

Fact: The foundry industry is the second largest user of grinding and finishing equipment in the U.S. What to do: 3 out of 4 visitors at the 1962 Exposition will be looking for better equipment to specify. Tell them YOUR story with a display at

THE BIGGEST FOUNDRY EXPOSITION IN 10 YEARS

66th CASTINGS CONGRESS and EXPOSITION

PLUS

29th INTERNATIONAL FOUNDRY CONGRESS

DETROIT
MAY 7-11, 1962
COBO HALL

FOR SPACE
WRITE, WIRE, PHONE

AMERICAN FOUNDRYMEN'S SOCIETY
GOLF & WOLF ROADS
DES PLAINES, ILL. • VA 4-0181

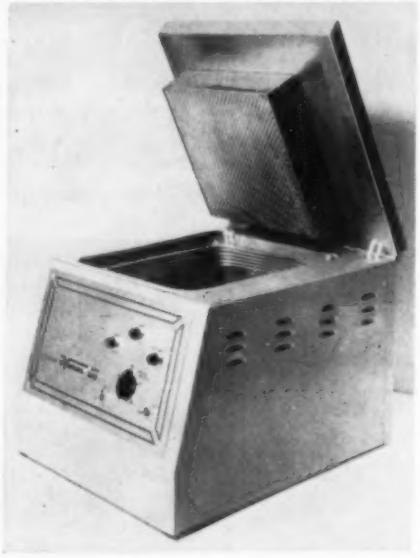
Use postpaid card. Circle No. 246

annodes in plating tanks and scour molds used to form plastic and glass. The pads are used for scuffing prior to painting, removing slivers and burrs, and for blending welds, especially on stainless steel and aluminum.

Minnesota Mining and Mfg. Co., 900 Bush Ave., St. Paul 6, Minn.

Use postpaid card. Circle No. 82

PARTS CLEANER USES NEW CLEANING METHOD



The Vatron 120, a new bench model parts cleaner, utilizes "vatronic cleaning," a new concept for the cleaning of small parts. The method has been used successfully in cleaning machined parts, electronic components, instruments, and lenses.

Vatronic cleaning means vapor cleaning in pure solvent vapors with simultaneous flushing action of pure solvent condensate that gently rains down on the work from the solvent shower lid condenser of the unit.

The Vatron 120 consists of an electrically heated stainless steel open-top cleaning chamber with condensing coils, and a hinged lid that is also a water cooled condenser. The under surface of the lid condenser is covered with a multitude of drip points on which vapors can condense to produce a rain-like flushing action.

Currier Co., 511 O'Neill Avenue, Belmont, California.

Use postpaid card. Circle No. 83

HIGH-SPEED NO-COOLANT SAW WITH GRINDER

Promacut Uni-14SA multi-purpose cut-off saw and pedestal grinder provides fabricating and maintenance shops with one economical unit combining a versatile saw with a general purpose grinding wheel. Makes accurate cuts of all types in carbon and stainless steels as well as many of the new alloys, without clamping or coolant.

Production Machinery, Inc., 4941 W. Belmont Ave., Chicago 41, Ill.

Use postpaid card. Circle No. 84

MAGNIFYING INSTRUMENT

With the Mark V magnifying instrument, readings can be made directly from the magnifying lens without removing the gage, turning it horizontally, or making any other adjustments. It incorporates a precision ground optical lens and mirrors, and magnifies scale numbers 2.5 times.

Pan Technics, Inc., 1230 Pan Technics Bldg., Encinitas, Calif.

Use postpaid card. Circle No. 85

"TWO STAGE" COOLANT CLEANING

A filtration unit that effectively removes all types of contaminant from coolants with a wide range of viscosities is now being marketed by Barnes Drill Co. The Kleenall filtration units, in five models with capacities from ½ to 60 gpm, perform "two stage" coolant cleaning.

As the coolant passes through the fabric filter, a seal wheel keeps dirty coolant from over-flowing at the

sides of the fabric. Flow of the coolant through the float wash coupling removes any swarf that may accumulate on the float.

Barnes Drill Co., 886 Chestnut St., Rockford, Illinois.

Use postpaid card. Circle No. 86

PROVIDES ABSOLUTE MEASUREMENT TO TENTHS

Providing absolute measurements to tenths for routine production, the DR-25B optical gage is accurate to .000025" and operates within normal temperature ranges without correction tables. It incorporates a precision-ruled scale and is suited for the gaging of parts on which a number of dimensions must be checked.

Bausch & Lomb, Inc., Rochester 2, New York.

Use postpaid card. Circle No. 87

RUST PREVENTIVE

Magnafilm 120 is a composite of film-forming materials and rust inhibitors dissolved in a safety solvent. After application, the solvent dissolves, leaving a thin, semi-solid, transparent polar film which will not crack or expand with contraction or expansion of the protected metal.

Magnus Chemical Company, Inc., Garwood, New Jersey.

Use postpaid card. Circle No. 93

REUSABLE HIGH PRESSURE HOSE FITTING

The Iron Mike is a new type of detachable, reusable fitting for high pressure hose fittings. It consists of three components: (1) a tapered steel socket; (2) two aluminum segments which grip hose reinforcement securely; and (3) a steel nipple which fits into hose and does not cut hose inner tube. The fittings have been designed for hose sizes ranging from ¼" to 2".

Aeroquip Corp., Jackson, Mich.

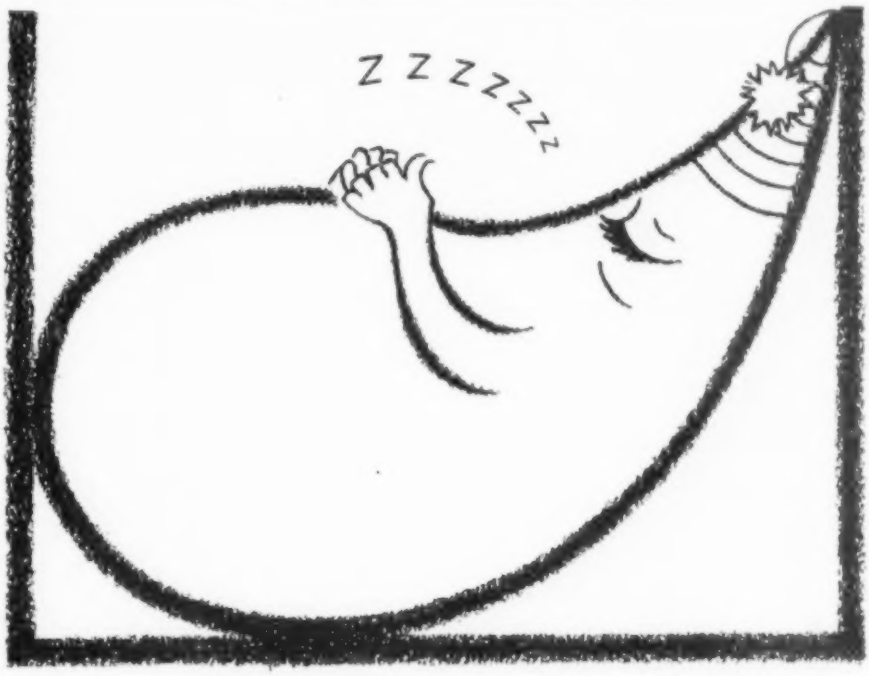
Use postpaid card. Circle No. 88

RANGE DIAL INDICATOR

By eliminating the conventional rack and pinion and incorporating a new type of motion transfer arrangement, the Micro-Sure Indicator is able to provide high magnification (.000050" grads.) over the FULL AGD range with two to four times the calibration and repeat accuracy of conventional indicators. The new design also prevents stem bushing wear from having any effect on accuracy.

Federal Products Corp., Providence 1, Rhode Island.

Use postpaid card. Circle No. 89



Are you the victim of a lazy coolant?

Does your grinding coolant or oil just seem to lie there — making the rounds from tank to work — but without helping the wheel cut — without improving the work finish?

Is it sloppy about tolerances, chip-settling or rust? Does it smell bad?

If so, switch to a White & Bagley *lively* coolant! There's not a lazy molecule in a drumful!

W&B Chemical Concentrates— For very keen grinding action at very low cost.

W&B 1500 — for steel (and titanium)
W&B E-55 — for steel, cast iron, nonferrous metals.

W&B Lubricant 1888 — High-detergent oil-type soluble for better finishes, tolerances, on grinding *and* cutting.

W&B HD Soluble 2213 — Best combination of support and cooling for tough grinding and cutting jobs.

W&B Grinding Oil 1572 — Standard of the industry for extremely critical thread, gear, tap and form grinding.

To get the facts about *lively* coolants, write The White & Bagley Co., 88 Foster St., Worcester, Mass.

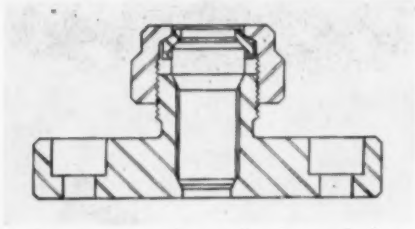
THE WHITE & BAGLEY CO.

Worcester, Massachusetts · Detroit, Michigan

Originators of Grinding Lubricants

Use postpaid card. Circle No. 248

REDESIGNED FACE PLATE MOUNTING



An improved, redesigned face plate mounting for using the '09 series collet chuck speeds setup in many operations where machine tools and fixtures are equipped with permanent face plates. Eleven chuck sizes are available, spanning a range from .013" through 8". The faceplate mounting has 4 bolt holes.

Erickson Tool Co., 342 Solon Rd., Solon, Ohio.

Use postpaid card. Circle No. 90

QUICK-ACTING PRESSURE UNIT

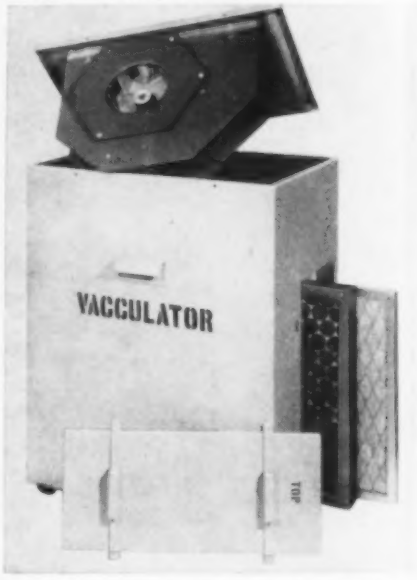
The Universal Vise and Tool Company has introduced its new, quick-acting pressure unit for use as a clamping component in jigs, fixtures, and other tooling and special clamping operations. It has a push-pull lock and release. A simple twist of the handle unlocks; a turn clamps the work.

The standard unit is suitable for clamping range of up to 8". The bar is furnished with a plain soft end for machining and adapting to any application. The specially designed locking arrangement features positive locking.

Universal Vise and Tool Company, Parma, Michigan.

Use postpaid card. Circle No. 91

DUST COLLECTOR



Vacculator Co., Inc., offers a line of cabinet-type dust collectors for which a high degree of efficiency is claimed. Three models afford approximately 400, 600, and 900 cfm capacities. All models are equipped with aluminum alloy impellers for spark resistance and also have exhaust silencers.

Vacculator Co., Inc., 49-55 Liberty St., Newark, New Jersey.

Use postpaid card. Circle No. 92

Grinding or Finishing ?

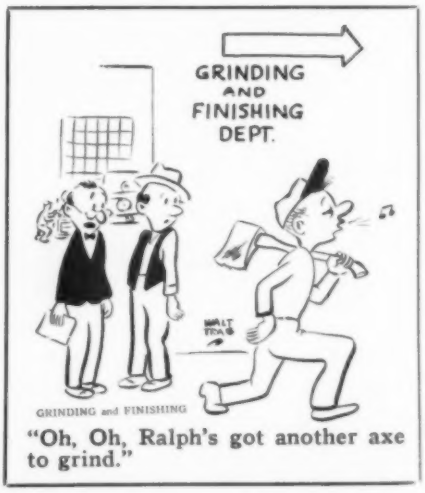
30 years of experience separate the NIKKEN from others!

It's the history of persistent research and development because of which the company has found the only reason of its existence in the grinding and finishing field. Now, even a single unit cannot pass through the company's quality control tests without the standard of quality that cannot be paralleled by others.

Yes, "development and research" is the words of NIKKEN's exclusive abrasives, which cannot be surpassed by any other make. And, because of the highest acceptance in the field, NIKKEN has the biggest share of Japan's overall production and sales.

NIHON KENSHI COMPANY, LTD.
(NIHON ABRASIVE CO., LTD.)
Bingo-machi, Osaka, Japan. Cable : "NIHONKENSHI"

Use postpaid card. Circle No. 250



"Oh, Oh, Ralph's got another axe to grind."

LIGHT WEIGHT MASTER VERNIER HEIGHT GAGE

A new series of Master Vernier Height Gages combine correct balance and weight for easier handling in applications where a lighter weight gage is preferred. They feature a long, 50-division vernier with widely spaced, easy-to-read graduations. Their open-face design permits having half as many bar graduations as conventional vernier tools.

L. S. Starrett Co., Athol, Mass.

Use postpaid card. Circle No. 94

NEW GRINDING WHEEL CONCEPT

A new concept in grinding wheels —a combination resilient rubber bond wheel having the metal removal qualities of a rigid resinoid wheel and the finishing properties of a flexible polishing wheel—was recently announced by Pekay Abrasives, Inc. The new wheel has been named "Agrabond."

Pekay Abrasives, Inc., 271 Grove Avenue, Verona, New Jersey.

Use postpaid card. Circle No. 95

LIGHT MAGNIFIES AND ILLUMINATES

Burton inspection lights that also serve as 3-power magnifiers feature the convenience of a soft fluorescent illuminator with a precision-ground magnifier built right into its center.

As industrial tools, these lights may be used for inspection, miniature assembly, for proof checking, and in such areas as the machine shop and laboratory. Ultraviolet tubes can be substituted.

Burton Medic-Quipment Division, Burton Manufacturing Co., 1918 E. Imperial Highway, El Segundo, California.

Use postpaid card. Circle No. 96

HAND CLEANER

A special process formula Ren hand cleaner contains an antiseptic ingredient which helps protect the hands by reducing the chance of secondary infections. The product safely dissolves grease, plastic, resin, hardener, and other problem soiling agents.

Ren Plastics, Inc., Dept. RP-95, 5422 S. Cedar Rd., Lansing, Mich.

Use postpaid card. Circle No. 97

SHORT RUN AIR GAGING

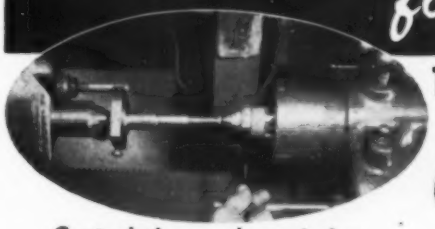
Standard Gage Company has announced a complete selection of adjustable, manual air gages. Designs proven in actual use for as many as 20 years are now adapted to air.

They include Standard's bore gages available in seven sets to cover I.D's from .123" to 24"; 12 adjustable Airsnaps cover all O.D.'s to 12".

Other adjustable manual gages cover such types as shallow diameter gages, P. D. comparators, and regular bench type comparators.

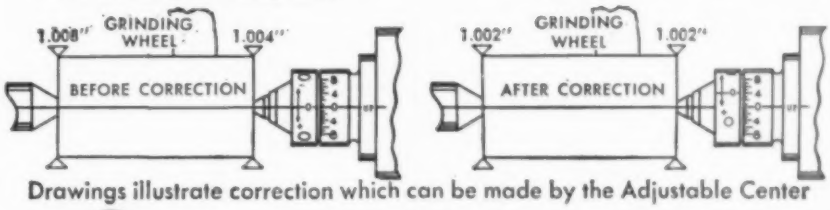
Standard Gage Company, Inc., Poughkeepsie, N.Y.

Use postpaid card. Circle No. 98

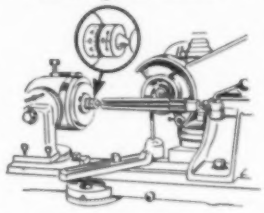


The Enco Micro-Set® Adjustable Center

Center being used on grinder

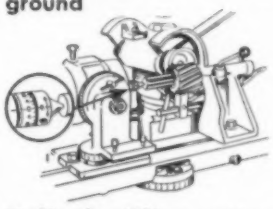


Drawings illustrate correction which can be made by the Adjustable Center



- Permits TRUE work alignment from tailstock or headstock on: cylindrical grinders, cutter grinders, gear shavers, lathes and tracer attachments.
- Saves one half the setup time.
- Ends hit or miss table adjustments to obtain precise alignment.
- An inexperienced operator can get a precise alignment—easily—in seconds.
- Quickly pays for itself in time and scrap savings.

Taper reamer being ground



Helical milling cutter being reground

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JARNO
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We also manufacture Precision Lathe Turrets and Tiny-Titan Magnet Base Holders.

Enco MANUFACTURING CO. Dept. 881, 4520 W. Fullerton Ave., Chicago 39, Ill.

Write for catalog and nearest distributor.

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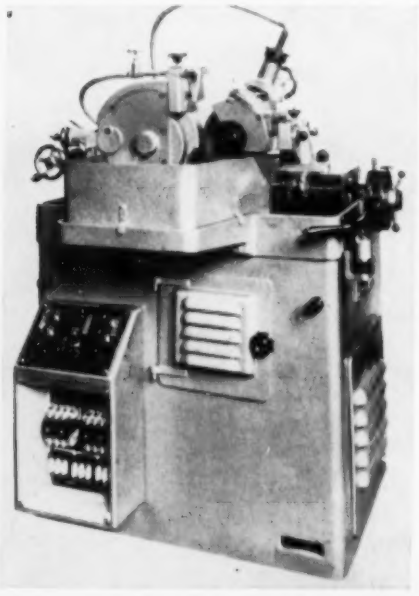
CENTERLESS HIGH PRECISION GRINDERS

Improved design features of the new 1961 models of the Elgin Centerless high precision grinders include hydraulic diamond dressing; automatic plunge grinding; crush dressing to grinding wheel; hydraulic trace forming to grinding and regulating wheels; and oscillation of grinding wheel spindle.



The machines are ruggedly built to give unusually accurate finishes. Special lapped steel shafts rotating in bronze precision bearing operate in full-flow lubrication.

S & S Machinery Co., 140 53rd St., Brooklyn 32, N.Y.

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CHUCK-SEGMENT COMBINATION

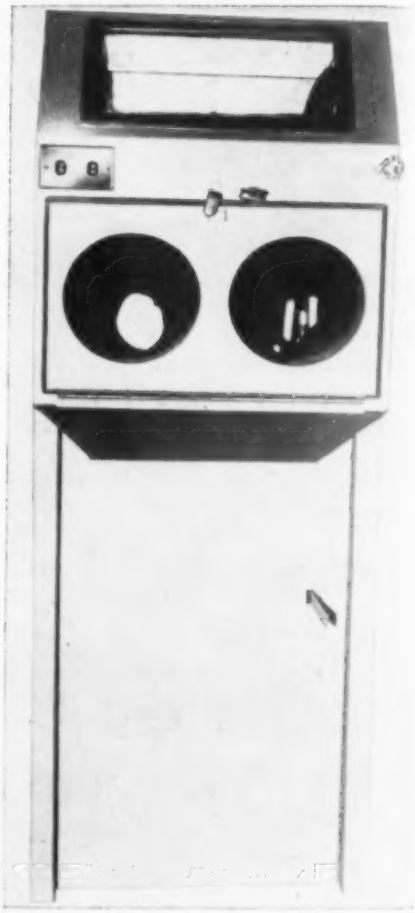
An exclusive feature of the FM-AA chuck and segment combination is the circular echelon or staggered, over-lapping segment arrangement. This, combined with a novel segment design, permits faster cutting and clears chips and grinding residue from the work automatically.

The combination permits low cost per cubic inch of usable abrasive. The unique clamp body design permits the use of one standard segment shape, regardless of chuck size, to cover most vertical spindle surface and horizontal spindle face grinding requirements. The improved chuck is available in standard sizes from 9" to 60" in diameter.

Fuller Merriam Company, Water Street, West Haven, Connecticut.

Use postpaid card. Circle No. 100

LOW-COST UTILITY WET BLAST UNIT



The Pressure Blast, Jr., a low-cost utility wet blast unit, was designed to meet the intermittent need for heat treat scale removal, cleaning prior to plating, cutting tool honing, and general metal finishing work.

The unit measures 22" square and stands 57" in height. A front bottom-hinged work loading door incorporates armports fitted with arm rests and drip-proof gauntlets.

The blast gun is suspended by its air and slurry hoses and is trigger-actuated. Air agitation of the abrasive and water mixture in the slurry has been eliminated in favor of mechanical agitation.

The agitator consists of a sealed shaft coming through the hopper fitted with four stainless steel paddles. The shaft is rotated by a direct coupling to a ¼ hp enclosed motor.

Pressure Blast Manufacturing Co., Inc., 27 Pleasant St., Manchester, Conn.

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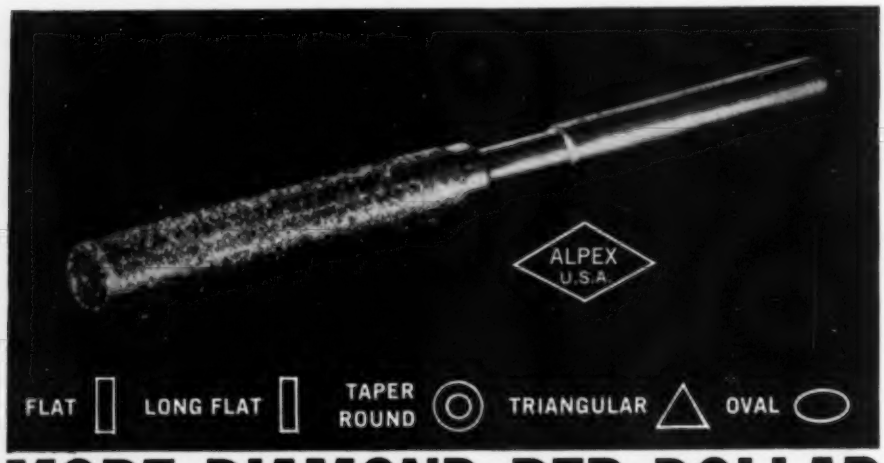

MORE DIAMOND PER DOLLAR

A complete line of files made from selected quality diamonds with sharp natural cutting edges exposed. For use in machining and profiling of carbide and ultra-hard materials. Alpex products are made to the standards of American industry, are available in different shapes and sizes, and are in stock for immediate delivery. An examination and trial will prove that Alpex files contain more working diamond surface per dollar.

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ALPEX WHEEL COMPANY

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ABRASIVE BELT CHART AVAILABLE

A new coated abrasive belt application chart that describes the correct abrasive belt and contact wheel for metalworking and other applications is now available.

The chart includes information on the correct abrasive, grit size, belt speed, lubricant, and contact wheel type for grinding, finishing, and polishing all types of materials.

It also provides a contact wheel chart which describes the correct type of contact wheel, wheel material, wheel hardness, and wheel action for various applications.

Coated Abrasives Div., Armour Alliance Industries, 16123 Armour Street, Alliance, Ohio.

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COMPARATIVE MEASURER

Measuring jaw of the APV unimeter operates without play and friction and is spring actuated to give constant measuring action.

After reference dimension has been set up with gage blocks or otherwise, unskilled personnel can measure accurately and quickly with the accuracy of the indicator being the limiting factor.

Anvils are available for O.D., I.D., O-groove, V-groove, and thread measuring. Ranges from 1½" to 14" are available as standard.

Homestrand Machine Tool Corp., 392 W. Putnam Ave., Greenwich, Connecticut.

Use postpaid card. Circle No. 104

PORTABLE SANDBLASTER

Designed for use throughout industry where there is a need for fast, economical sandblasting, the Model 28A portable sandblaster features a unique squeeze grip abrasive delivery nozzle which allows the operator to control and shut off the abrasive flow at will.

The unit can be easily filled with abrasives through a built-in funnel. Its filler valve automatically opens and closes with tank pressure. The mixing chamber mixes abrasive and air under the tank.

Handi-Blast Division, Hamill Mfg. Co., Inc., Washington, Mich.

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DIAMOND LAPPING COMPOUNDS

New techniques for making diamond lapping compounds have been developed by the West Coast Diamond Tool Co. The compounds are available in new disposable, nonbreakable plastic syringe applicators which provide waste-free, pinpoint application.

The new technique of crushing gives the diamond particles their maximum cutting efficiency, uniform shape, and greater resistance to breakdown.

West Coast Diamond Tool Co., 403 N. Foothill Road, Beverly Hills, California.

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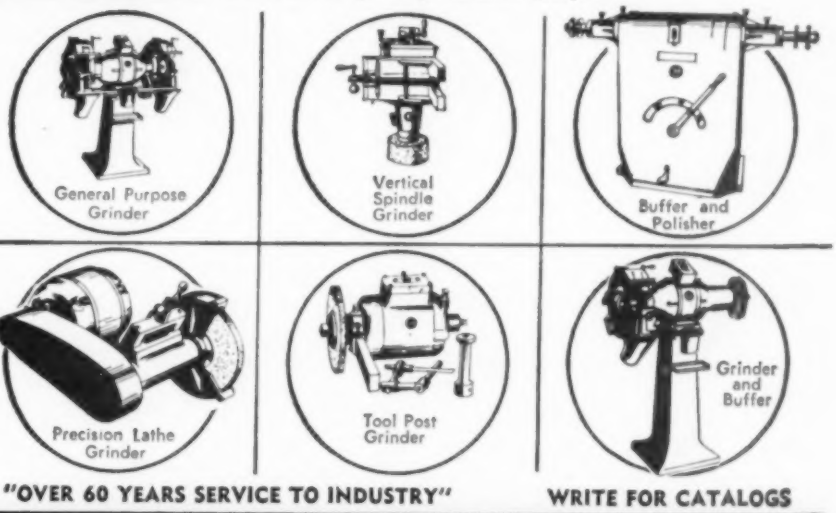
An investment in better, faster, production through the use of tools expertly designed and conscientiously crafted for your particular purpose.



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for manufacturing management

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IV Cost Reduction Specialist
V Developing the Cost Reduction Program
VI Waste Prevention
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Exhibit D How And Where To Cut Waste
Exhibit E Waste Which Foremen Can Prevent
Exhibit F Cost Reduction Idea, "MT" Day
Exhibit G Principal Tools Of Work Simplification
Exhibit H Package Planning Check List
Exhibit I Adams Computer Characteristics Chart

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FORMAL OPENING OF CARBORUNDUM ABRASIVE CENTER

Some 600 guests attended the formal opening of the new Carborundum Abrasive Center, 2240 S. Yates Ave., Los Angeles, Calif. The center was built at a cost of about $1.5 million.

It stocks a $1.5 million inventory selected to meet abrasive requirements of the Los Angeles marketing area. In addition, the center carries super refractories, electronic components, and a wide variety of cutting tools and shop supplies.

Of major interest to visitors were the operations in the three departments of the center, where grinding wheels, abrasive belts, belt machines, and tumbling machines were demonstrated.

According to John F. Claydon, Carborundum vice president and general manager of its Coated Abrasives Division, the new center was the latest action of the company in its long-term plan to participate in the future growth of business and industry on the west coast.

John F. Claydon (left), vice president of The Carborundum Company and general manager of its Coated Abrasives Division, joined Harry M. Bayley, vice president and general manager of Pacific Abrasive Supply Company, a Carborundum subsidiary, to welcome some 600 guests at the formal opening of the new Carborundum Abrasive Service Center in Los Angeles, Calif.

SAX CONDUCTS MANAGEMENT SEMINAR

L. B. Sax

Leonard B. Sax, president of American Buff Co., 2414 S. LaSalle St., Chicago conducted a one-week seminar held in mid-June at Saranac Lake, N.Y.

The seminar was attended by presidents of corporations with annual sales volumes averaging six to seven million dollars. The American Management Association selected Sax as chairman for the seminar discussing "The Chief Executive's Job in the Smaller Company."

MAN-MADE DIAMOND IN ELGIN LAPPING COMPOUND

The Metallurgical Products Department of the General Electric Company, Detroit, Mich., has announced that its Man-Made diamond is now being used in a compound produced by the Abrasives division of the Elgin National Watch Company, Elgin, Ill.

The diamond is to be used in Elgin's Dymo-D compound, developed by Elgin specifically for the lapping of diamond discs. With this additional application, Man-Made diamond is now commercially available in grinding wheels, micronized powder, and compounds.

KLINGSPOR AWARDED GOLD MEDAL

The president of the German Inventor-Association, Hans Keller, presented 71-year-old inventor Carl Klingspor with the coveted Diesel Gold Medal Award.

Klingspor received the medal for the invention and manufacture of long-lasting, high strength, and break resistant abrasives with high cutting speed and efficiency. He is the president of the American Crownflex Abrasive Wheel Manufacturing Company, Delanco, N.J.

NU-MATIC ANNOUNCES 35% PRICE REDUCTIONS

Nu-Matic Grinders, Inc., Cleveland, Ohio, has reduced their entire price structure on Flexcore expanding type sanding wheels. These wheels, built to grip the abrasive sleeve by centrifugal force, have been reduced in price by 20% across the board and some items have been reduced by more than 50%. Nu-Matic states that the average price reduction is in excess of 35%.

NORTON ESTABLISHES NEW DEPARTMENT

Norton Company's Abrasive Division has established a new department which will be responsible for developing new products. John C. Ewer will head the department as Manager of Product and Market Planning.

The department is to be responsible for generating and screening new product and market ideas, market research, the initial economic and financial analysis of these ideas, and coordinating this growth effort with other departments and divisions.

One of the first projects is the development of further information on abrasive machining.

continued

If you want to get a personal copy of GRINDING and FINISHING regularly . . .

GRINDING and FINISHING is regularly distributed to qualified users of abrasives at their company addresses.

The magazine is also available on subscription to anyone interested, user or not, as explained below. (Supplier member of the American Society for Abrasives may subscribe at a special rate of $4.50 per year.)

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INDUSTRY NEWS continued

Preliminary work has already shown that many metalworking operations can be done quicker and at less cost when abrasive wheels are used to remove heavy amounts of metal in operations previously thought to be suitable only for milling machines, planers, or shapers.

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USE IT EITHER WAY

Full 1/3 h.p. G. E. Motor

At last, a top quality industrial sander that provides all the most wanted features — yet sells for so little.

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U. S. Distributor of Hermes coated abrasives, a quality product now being used by hundreds of U.S. firms, requires sales agents for several choice territories including Southern California, the Rocky Mountain States, Missouri, Southern Illinois, Kansas, Louisiana, Georgia, Alabama and others.

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AUTOMATION SERVICES, INC.
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GRAIN, GRIT, SHOT

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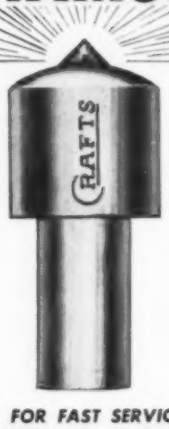
Around the industry . . .

Continental-Emsco Company's Industrial Sales Division has recently concluded arrangements to represent the Products of Besly-Welles Corp., Cutting Tool and Gage Division, South Beloit, Ill., and also of Wheel Trueing Tool Company, Detroit, Mich.

The Abrasives Division of the Elgin National Watch Co., Elgin, Ill., has announced the appointment of the following six companies as distributors for the Division's Diamond Wheel Products: Baldwin-Hall Co., Inc., Potsdam, N.Y., and Syracuse, N.Y.; George V. Morris, Philadelphia, Pa.; Quad Tool and Die Supply, Merchantville, N.J.; Tool and Abrasives Engineering Co., San Jose, Calif.; and Tool Mart, Inc., Van Nuys, Calif.

Southwestern Engineering Co., Los Angeles, Calif., has named seven new representatives for the sale of its new Sweco Vibro-Energy Finishing Mills: S. A. Day Mfg. Co., Inc., Buffalo, N.Y.; C. Burwell, Inc., Clifton, N.J.; John R. Nielsen & Sons:, South Windsor, Conn.; Precision Finishing Co., Sellersville, Pa.; A & B Deburring Co., Cincinnati, Ohio; Abrading Machinery & Supply Co., Chicago, Ill.; and Fortune Metal Finishing Co., Newton Lower Falls, Mass.

DIAMONDS RESET



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H. G. Brustlin

W. J. Eames

J. P. Finn

Dr. Z. D. Sheldon

Harry G. Brustlin, formerly manager of marketing service, has been named general sales manager of Norton Company's Abrasive Division. Irvine F. Williamson was appointed manager of Norton's Santa Clara, Calif., plant. Raymond B. Goodale, formerly Norton's grinding wheel sales representative in the Iowa area, has been transferred to a similar post in the Cincinnati area to succeed the late Sherwood F. Prescott. Robert D. Stubblebine, succeeds Goodale in the Iowa Area. Robert L. Hager has been appointed Norton abrasive grain specialist in the Pennsylvania area to succeed Frank A. Singer who has retired.

Harrington-Wilson-Daum Corp., Mt. Vernon, N.Y., has appointed John P. Finn vice president in charge of their sales organization.

William J. Eames has been named superintendent of the Grinding Wheel Division of Electro Refractories & Abrasives Corp., Buffalo, N.Y.

Dr. Zachary D. Sheldon, formerly manager, Advanced Materials Development, General Engineering Laboratory, General Electric Company, Schenectady, N.Y., has joined the Carborundum Company as associate director of the Research and Development Division, Henry J. Killmar has been appointed manager of the Division's new Products Branch to succeed Frederick J. Ross, Jr., who has been named assistant to the general manager of Carborundum's Bonded Abrasives Division.

Harold R. Dillow has been named manager of marketing for Wheel Trueing Company's Trulap products.

Ralph Simons has been promoted assistant sales manager Machine Tools Division, Van Norman Machine Co., Springfield, Mass.

Curtis I. Kahler has joined Bay States Abrasive Products Co., Westboro, Mass., where he will continue in abrasive honing stone application work.

New crushing techniques for diamond lapping compounds give greater resistance to breakdown and maximum cutting efficiency. Developed by West Coast Diamond Tool Co., *these compounds guarantee you perfect satisfaction backed by the integrity of 3 generations in industrial diamond skill.*

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DIAMOND
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SYRINGE
APPLICATORS
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Compounds are available in mesh and micron sizes for lapping down to a one-half microinch finish . . . and come in disposable, non-breakable plastic, Syringe Applicators (at no additional charge). Try West Coast on your next order! You'll save money and turn out a better job! *Write for Price List and "Facts You Should Know About Diamond Compound"*

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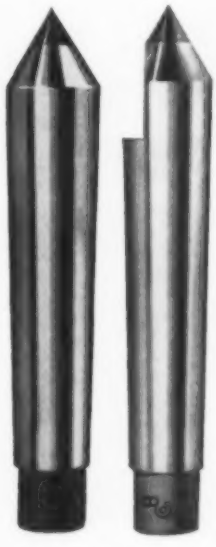

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The accurately ground alloy steel shanks have a Rockwell "C" hardness of over 60. This prevents damage while handling which might affect their proper seating in the grinder. The design of the shank prevents damage when the center is being removed from the machine.

Extra large, highest quality carbide insert enables the point to be reground an endless number of times. Precision point is lapped to a mirror finish.

Both centers and half centers are available in Brown and Sharpe, Jarno and Morse Tapers. They are available from stock in popular sizes. Write for prices and literature.

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CLEVELAND 14, OHIO

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enriched with *GRANULAIDE**

New Trulap Diamond Lapping Compound gives you more lapping mileage because we've added Granulaide. Granulaide s-t-r-e-t-c-h-e-s the active life of Trulap compound by keeping it from becoming liquid and draining away, and by keeping the diamond particles dispersed and active within the paste. Trulap is laboratory made, not factory made, so it is clean—"laboratory clean". Uniform blocky shaped diamond particles give uniform lapping action—scratching "spears" or "blades" are out. Industry's most complete range of particle sizes, accurately graded, in dispensers from 2½ grams up. Write for folder.

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Grinding and Finishing

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Theory of Cutting Action

A composite of panel speeches by Cincinnati Milling Machine Company personnel on the results of their studies in the theory of grinding. Discusses the many ramifications of how an abrasive grain in a wheel cuts metal.

Grinding the Space Metals

Summary of an Air Force research report on abrasive machining of high-strength, thermal-resistant materials for missiles and rockets.

Jig Grinding Contours

Conclusion of two-part series discusses the grinding of slots, blending of radii, and other operations in the grinding of internal contours.

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designed to collect dust from single machines
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Self-contained Dustkop models, like the "520," are practical and effective in collecting dust from single machines. They're designed specifically for service with surface grinders, tool and cutter grinders, offhand grinders, buffers and other small wheel equipment. These units are also easy to install — are actually portable — and very economical to operate.

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here's why
AIRETOOL'S 400G
cuts grinding costs

Designed for heavy duty, small wheel grinding. Powerful air motor stands up . . . without heating up . . . under continuous grinding of large dies, castings and patterns. Easy to handle; cuts operator fatigue; boosts production.

Accurate. Tailored for precision die grinding, accurate metal removal and other intricate grinding operations.

Versatile. Collet Chuck uses wide range of rotary mills. Wheel adapter (illustrated) makes abrasive wheel mounting easy for fine finishing of inside surfaces. Spindle models available.

Threaded Adapter For use with ¼" Collet Chuck

. . . get the right pneumatic tool for every job . . . send for Bulletin 70

AIRETOOL MANUFACTURING COMPANY SPRINGFIELD, OHIO

More than 30 years' experience in pneumatic motor equipment

Branch Offices: New York, Chicago, Tulsa, Philadelphia, Houston, Baton Rouge
Representatives in principal cities of U.S.A., Canada, Mexico, South America, England, Europe, Puerto Rico, Italy, Japan, Hawaii.
Plants: Canada and The Netherlands

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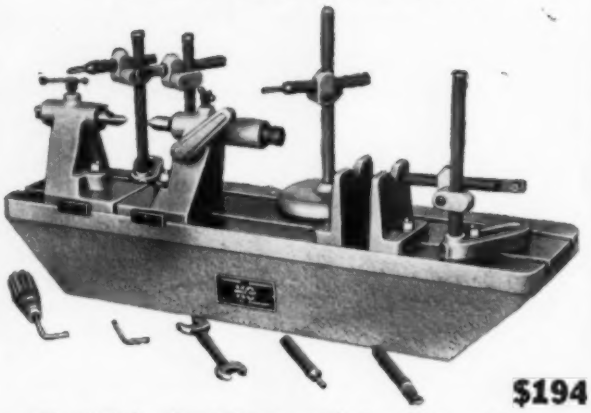
Bench Center
and Surface Plate



$194

The K. O. Lee Bench Center and Surface Plate provides an accurate means for inspecting all types of work. Work pieces can be mounted between centers, in V-rests or on precision ground surface plate. Surface plate tolerance for flatness is .0002" per foot. Runout is shown on dial indicator as work is rotated by hand. Side runout or camming action can be checked with second indicator.

Tailstocks can be positioned any place on the T-slot. They are rigidly mounted on base with top and side lock. The tailstocks are ground in pairs assuring that both centers are exact height from the plate. Work can be placed in position or removed easily with the use of the quick release lever. Centers are alloy steel, hardened and precision ground. WRITE FOR COMPLETE LITERATURE.

K.O. Lee Co.

ABERDEEN, SOUTH DAKOTA

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HEAVY DUTY GRINDER SHARPENS METAL CUTTING SAWS TO 84" DIA.

For large Diameter Saws of all types, Inserted tooth, Segmental or solid tooth. Adjustable to wide variety of tooth spacings. Extremely heavy duty Construction Ball and Roller bearing throughout. Saw teeth generated by cam control. Adjustable by means of conveniently placed hand wheels to wide range of tooth spacings and depth of saw teeth. Saw is carried on heavy duty roller bearings for greater accuracy and fine finish.

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EXTRA HEAVY CONSTRUCTION *for HEAVY DUTY* PRODUCTION

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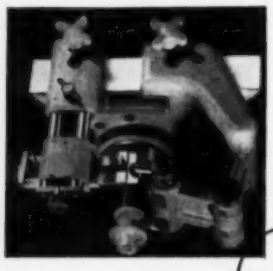
TRACAFORM

MODEL SMD-704

NEW 1:1 Ratio SPINDLE MOUNTED CONTOUR WHEEL DRESSER



TRACAFORM solves your wheel dressing problems:

- Complex Shapes to "tenths" accuracy!
- Low in Cost (appr. 1/5 cost of other spindle-mounted dressers)
- High in performance and quality!
- Dresses wheels from 7" dia. by 4" wide—down to the smallest diameter mounted wheel!

- Unnecessary to use costly lapped diamonds!
- Stylus easily ground to exact shape of diamond! Diamond wear easily corrected!
- Intricate forms can be dressed into the wheel repeatedly without losing location or disturbing work being ground.
- Fits most surface grinder spindles using 7" dia. or less grinding wheels!

TRACAFORM CORPORATION 11380 KALTZ • WARREN, MICH.

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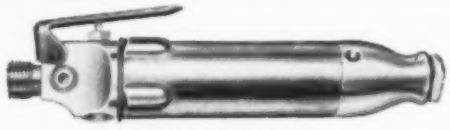
PNEUMATIC GRINDER



MODEL 60

Power to Spare—Easy Handling
Light Weight—15 Oz.

SPEED 50,000 R.P.M. . . . OVERALL LENGTH 6½". This husky little grinder, when used with Carbide Burs, Rotary Files and Mounted Wheels, produces astonishing results on real production work. It continues to do so with the minimum of time out of service. AIR CONTROL LEVER for starting and stopping flexible and efficient. ADJUSTING SCREW regulates speed for varying air pressure. BEARINGS special greased. Spindle accommodates mandrels ¼" dia. A collet ¼" O.D. ⅛" or 3/16" I.D. available for use in spindle.

WRITE FOR LITERATURE

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Have you entered

the Grinding Wheel Institute

AWARD PROGRAM

THEME: Your Case for Grinding.

PURPOSE: The goal of this program is to uncover the many yet unwritten stories of beneficial applications of bonded abrasives. It is also intended to provide recognition to those in the metalworking industry who have increased the beneficial application of bonded abrasives.

RULES: All entries must be articles which describe actual bonded abrasive operations in the metalworking field which have proved to be beneficial to the user. The articles must be typewritten and include glossy photos and/or inked drawings if possible.

The article should include all pertinent information about the operation, equipment, abrasives and accessories. The article should answer the question, "How did the bonded abrasive operation benefit the manufacturer?" This should include comparison with previous operation if available.

Entries are open to everyone except employees of bonded abrasive manufacturers. Approval from company concerned should accompany the article.

Length of the article and number of photos and/or drawings are not limited. Use as many words or photos as are required to tell the story clearly. Every article will be accepted or returned within one month of receipt. All publishing rights to the articles will become the property of Grinding and Finishing. Send all entries to Grinding and Finishing, Wheaton, Ill.

JUDGING OF ACCEPTANCE: All articles will be judged on the importance of the benefits and completeness of the information. Literary ability *will not* have any bearing on acceptance or rejection of an article. Those articles accepted will not be limited to one per month nor will they be based on a comparison of those received. This is not a contest.

AWARDS: For each article accepted the author will receive $50 and a plastic encased copy of the article as it appeared in Grinding and Finishing. These will be presented formally.

TIME OF PROGRAM: The program started in February with the first article accepted being printed in the March issue. The length of the program has not been set, as it is felt by the sponsors that there is a wealth of information available and that only lack of participation will determine length.

SPONSORS: Grinding Wheel Institute in cooperation with Grinding and Finishing.

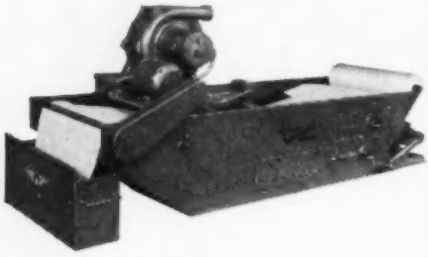
HOFFMAN INDUSTRIES, INC.

A SUBSIDIARY OF HOFFMAN INTERNATIONAL

FILTRATION DIVISION **Thompson Road Plant, Syracuse 1, N.Y.** **HOward 3-0251**

Pressure Filters, Flotation Units, Vacu-Matic Filters (Vacuum Type), Vacuum Stills, Magnaflo Magnetic Separators, Suction Type Filters, Disc Type Filters, Central Systems.

HOW REVOLUTIONARY NEW HOFFMAN VACU-MATIC FILTERS HELP ELIMINATE HIDDEN MACHINE TOOL COSTS

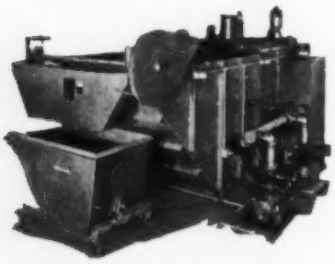


Standard size Hoffman Vacu-Matic filters provide continuous filtration of machine tool water soluble coolants at flow rates from 40 to 120 GPM. The new and larger Hi-Flo Vacu-Matics employ the same basic principles in handling flow rates ranging from *200 to 2500 GPM.* Coolant is drawn through the filtering paper by negative pressure with the dry sludge remaining on top. When sludge reaches a pre-set thickness, the filter paper is automatically indexed through a pressure differential switch and new paper moved over the vacuum area. Water-free sludge and filter paper drop off into the removable tote box for easy disposal with these beneficial results:

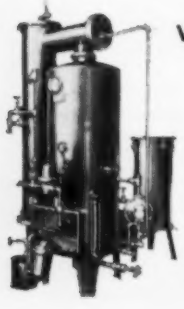
- **Down time eliminated**
- **Coolant loss minimized**
- **Rejects reduced**
- **Bacteria growth curtailed**
- **Production schedules maintained**

Ask for Bulletins FB-103 and FB-107

FLOTATION UNIT FOR METALWORKING OPERATIONS

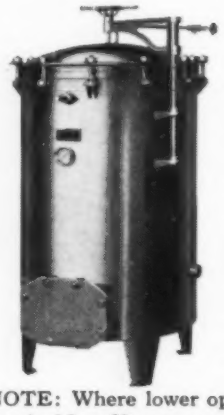


By achieving continuous fully automatic clarification of water soluble oil coolants, flotation units increase productivity of machine tools — completely eliminate down time due to failure of coolant supply and need for sump cleaning. Propelled by gravity, contaminated machine tool coolant flows to tank and is transferred to flotation cell for aeration by rotor-stator. Waste solids are held in suspension by froth and skimmed off. Sludge is automatically removed in near-dry form by a built-in sludge collector. *Liquids are clarified mechanically without screens, filter-aid powders or disposable media such as cloths, bags or papers. Individual motor pumps are eliminated, life of coolant prolonged indefinitely, bacteria growth controlled, housekeeping made simpler and more efficient.* Standard flotation units available for flow rates from 40 to 1500 gpm. Central flotation systems engineered to serve large numbers of machine tools. **Send for case histories and Bulletin FB-102.**



VACUUM STILLS FOR SOLVENT RECOVERY

At a cost of about 1c per gallon, Hoffman Vacuum Stills reclaim to new specifications the petroleum or synthetic solvents employed in the washing and cleaning of parts, tools, fixtures, dies, paint stripping and various industrial processes such as the manufacture of extruded parts, aluminum foil rolling, etc. Savings can be expected to pay for the Hoffman equipment in a short time. **Send for Bulletin FB-101 and Case Study #12.**



PRESSURE FILTERS FOR FINE FILTRATION

Designed for use with approved filter powder, Hoffman Pressure Filters are widely used with grinding, cutting and honing oils as well as water soluble oil coolants where finest clarity is consistently required. Built to withstand pressures up to 40 pounds per square inch, these filters are well adapted to central filtration systems handling oils or coolants from large groups of machines. They can also be used to filter industrial water for recirculation. **Ask for Bulletin FB-100 and case study.**

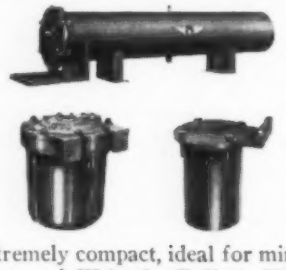
NOTE: Where lower operating efficiency ratios are adequate, economical bag filters are available.

MAGNAFLO SEPARATORS FOR REMOVAL OF FERROUS SOLIDS

- **A low cost package unit**
- **Removes 75% to 90% of ferrous solids**
- **For flow rates from 40 to 1000 GPM**
- **Fully automatic and self-cleaning**
- **Requires no maintenance**
- **Delivers near-dry sludge**

Hoffman Magnaflo Separators are designed for continuous operation. Fully automatic and self-cleaning, they are capable of removing 75 to 90% of all ferrous solids, operate without supervision and require little or no maintenance even in continuous operation. For full details on Magnaflo Separators to provide simple automatic removal of ferrous materials from cutting oils and water-soluble coolants. **Send for Bulletin FB-105.**

DISC FILTERS PROVIDE CONTINUOUS FLOW IN SMALL SPACE



- **Low Initial Cost**
- **No Moving Parts**
- **Easy to Clean and Install**

Developed and used extensively by industry for filtration of oils containing fine particles (measuring from 3 to 5 micron size or larger) which must be removed to obtain the desired results. Extremely compact, ideal for minimum space. Discs can be cleaned and re-used. **Write for Bulletin FB-104.**

INDUSTRY RELIES ON HOFFMAN FILTRATION SYSTEMS

Hoffman Filtration systems clarify, filter and reclaim coolants, oils, solvents as well as industrial waters in the chemical, metalworking, automotive and other industries. Engineered to increase production and lower costs, they reduce down time and maintenance, extend the useful life of coolants and lubricants, provide better finishes with fewer rejects, insure longer runs, finer tolerances and other benefits. Engineering surveys are available without cost or obligation.

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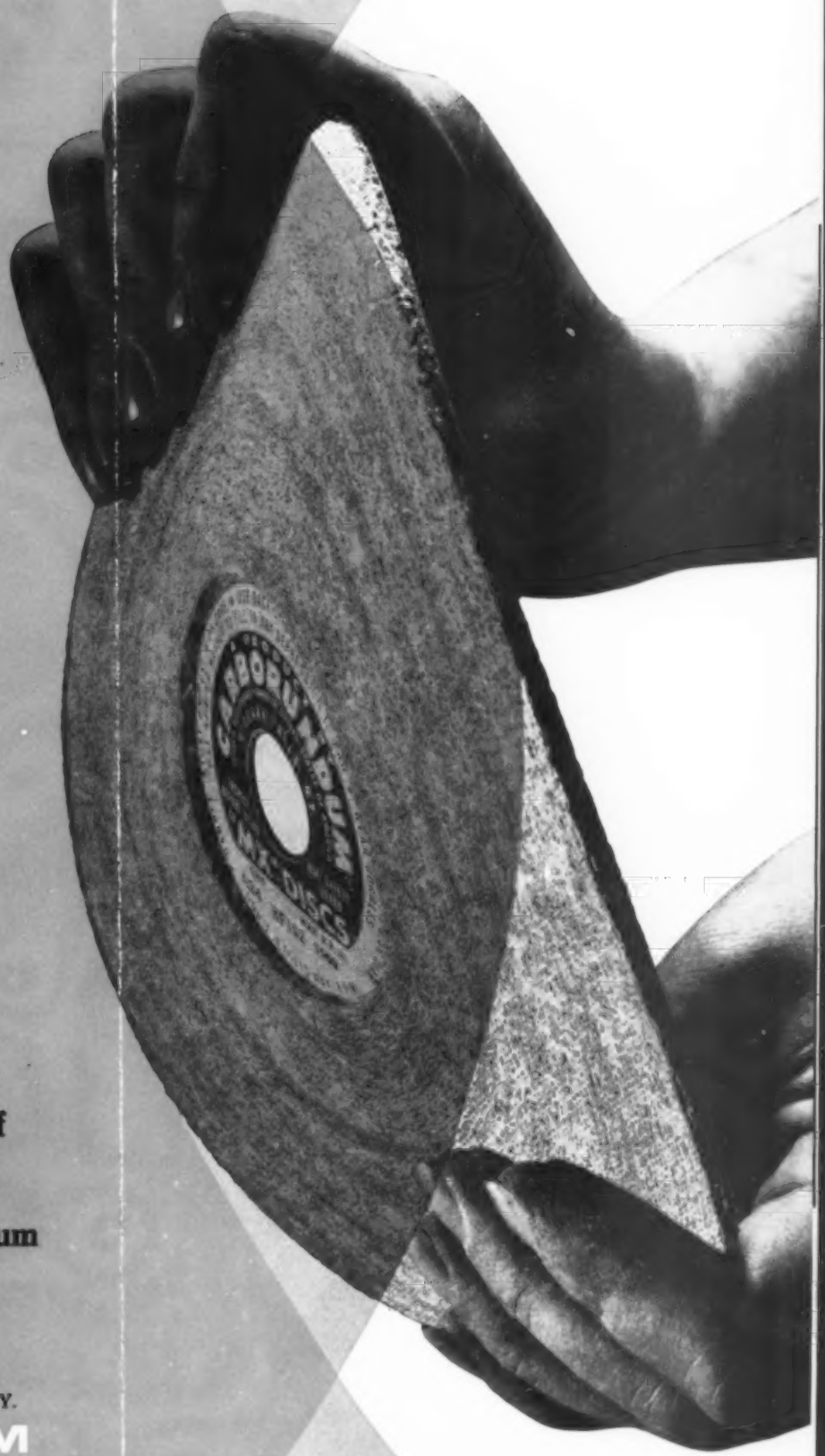
Now you can end forever the costly, time-consuming annoyance of changing discs between roughing and finishing. To take off metal rapidly with the new flexible MX® disc, simply bear down—watch the disc hug the workpiece as it grinds off stock. Then let up and finish the job with an easy smooth motion—all with the same disc! Use this remarkable new abrasive tool on flat work or on contours. Use it to remove welds, take out dents and imperfections—for hundreds of jobs on regular steel, stainless or aluminum. Your Carborundum distributor or representative will be glad to help.



Bonded Abrasives Division • Niagara Falls, N. Y.

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The Payoff is Performance

G-E Man-Made diamond bats 1.000 against high costs

Do you want to *do* something about high costs . . . boost your grinding efficiency . . . step up output per wheel?

Grinding wheels with G-E Man-Made diamond are making important contributions to the metalworking industry. An on-the-job test would show you that the crystal characteristics of controlled shape and friability that are built into G-E Man-Made diamond result in consistently superior grinding performance—bat 1.000 every time!

Do this. Call your grinding wheel supplier and order a wheel containing G-E Man-Made diamond. Test it in actual production in your own shop. You'll see what we mean.

A carbide cutting tool manufacturer — grinding single-point carbide tools — compared 6" x ¾" x 1¼" plain cup wheels, vitrified bond, 120 grit, 100 concentration — dry grinding. In this actual case history the natural diamond wheel removed 37.1 cubic inches of carbide, whereas the wheel containing G-E Man-Made diamond removed 53.4 cubic inches. Superiority of G-E Man-Made over natural? 44 per cent!

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL ELECTRIC

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